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# CHEMICAL AGE

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## WORLD FERTILISERS

**D**ATA presented in the 'Annual review of world production and consumption of fertilisers, 1957', by the Food and Agricultural Organisation of the United Nations (FAO) shows that world production and consumption of fertilisers have continued to increase steadily during the period 1955 to 1958.

Figures are available only to 1956 and these show that total world production of fertilisers (excluding rock phosphate) in terms of thousands of metric tons (TMT), of nitrogen (N), phosphoric acid (P<sub>2</sub>O<sub>5</sub>), and potash (K<sub>2</sub>O), was 20,179 TMT, an increase of 5 per cent over 1955. On the consumption side (again excluding ground rock phosphate), the total was 19,339 TMT, a 7 per cent increase on that of 1955. Estimates for last year indicate further increases of 4 per cent over 1956 in world production and consumption. Forecasts for 1958 are necessarily somewhat conservative and do not indicate any great reduction in the rate of increase of consumption. One of the difficulties here is that there is a lack of official forecasts for Europe, whose production is more than half the world total.

Most of the world's fertilisers are, of course, produced in Europe and North America and it is therefore of interest to compare the data given in the recent OEEC report on fertilisers (7th Study 1955-1958—see CHEMICAL AGE, 22 February, p. 389). According to the OEEC report the upward trend in fertiliser production was maintained in 1956-57. Production of nitrogen was up by 11 per cent, potash production rose by 5 per cent and phosphate production increased by 4 per cent. Consumption of fertilisers in OEEC countries showed a slight drop from 1955-56 (6.5 per cent) to 5.6 per cent. Consumption of nitrogenous fertilisers increased by 8 per cent, potash fertilisers by 6 per cent and phosphate fertilisers by 4 per cent. Forecast consumption for 1957-58 in OEEC countries is 6 per cent more for nitrogenous fertilisers, 3 per cent for potash and 1 per cent for phosphate fertilisers.

The FAO review (see also p. 559) indicates that the capacity of existing fertiliser plants and of new ones under construction or projected in various parts of the world promises to be more than sufficient to satisfy increased demands in the foreseeable future.

The change in world consumption of fertilisers during the decade since the end of the Second World War is shown by the comparison of 1947 and 1957 figures. For the year ending 30 June 1947, consumption of all commercial fertilisers in thousands of metric tons of nutrients (N + P<sub>2</sub>O<sub>5</sub> + K<sub>2</sub>O) was 8,850. Estimated consumption for the year ended 30 June 1957 is 20,639 (including ground rock phosphate applied direct). This increase in 10 years from less than 9 million TMT to over 20 TMT, expressed as a percentage is an increase of 133 per cent.

Of course, increases for individual countries or regions can show very wide variation above and below this world average. Reference has been made in previous FAO reviews to the fact that most marked increases in fertiliser consumption are occurring in highly developed and industrialised countries, where the level of fertiliser use is already high. Now that figures for the past 10 years are available this fact is most marked.

While the highly developed countries in 1947 accounted for over four-fifths

of the world's total fertiliser consumption, in 1957 their share of the more-than-doubled-total was still in almost the same proportion. At the same time these figures are even more emphatic when it is noted that the area of agricultural land in the highly developed countries is little more than one-third (38 per cent) of the world total. Thus the average intensity of fertiliser use on the farmed land of the highly developed countries is very much higher than that for underdeveloped countries.

Even then there is a very wide range of variation in the intensity of fertiliser use in the different countries considered among the industrially highly-developed. In Japan as much as 250 tons of fertiliser per 1,000 hectares is used and nearly 200 in Belgium and the Netherlands, compared with as little as 4 tons for Canada and South Africa and one for Australia. This variation is, of course, a reflection of the densities of population in the above countries. It should also be remembered that whereas low rates of fertiliser are used on a large proportion of the total farm land of Canada and Australia, the smaller areas of intensively cropped land use very high rates of fertiliser of a similar order to the Netherlands or Belgium.

The increased consumption of fertilisers noted in South and South-East Asia is considered to be due to greater use of fertilisers in paddy growing. There are good grounds, too, for expecting an even greater demand for fertilisers in this area when the results of the work of the regional soil specialist appointed by the International Rice Commission become more widely known.

### ACETYLENE IN THE US

MENTION of acetylene usually arouses interest among chemical manufacturers. In the US, however, there are two schools of thought about this chemical raw material's potentialities. A *Chemical and Engineering News* report on acetylene (1958, 36 No. 9, 112) indicates that projections of the growth curve now show a 12 per cent per year rate of increase. Big factors in US acetylene expansion in the next two or three years will be acrylonitrile, vinyl chloride and neoprene rubbers. Other factors are its uses for acrylates, halogenated ethylenes and vinyl esters. The largest percentage expansion is expected to be in Reppi products, methyl styrene, vinyl esters. There is evidently, on a long term basis, a less clear outlook for acetylene's expansion. The suggestion is made that what acetylene needs is a product like polythene.

Acetylene production costs in the US appear to be difficult to compute accurately. The two sources, natural gas and calcium carbide, are stated to compete both in cost and process. In the case of carbide-produced acetylene, transport costs have to be considered. Also the value of by-products is important in acetylene manufacturing cost. Lime recovery as practised in Europe has only found limited uses in the US. On the other hand, by-products from the acetylene process using natural gas, are hydrogen and carbon monoxide and with nitrogen from air fractionation, go to make ammonia and methanol.

It appears that the rising cost of natural gas is now being considered in the US. Because of this there is a possibility that liquid charge stocks may prove to be preferable compared with natural gas for acetylene. On the other hand, calcium carbide based on coal for both power and reducing agent plus limestone is being considered by some as likely to set acetylene's cost as prices for hydrocarbons increase. In this case acetylene would be in a better cost position compared with ethylene.

It is of interest to note that in the US carbide acetylene is sold widely on a merchant basis at prices ranging from 12.5 to 14 cents excluding freight charges. Although factory cost of 'petrochemical' acetylene is generally estimated at about 8 cents a pound, using 20 per cent natural gas, the suggestion is that 10 to 12 cents is more realistic even

with gas considerably cheaper than 20 cents a thousand cubic feet. Also of interest are the remarks in this survey that over-all capital investment for a hydrocarbon acetylene plant is twice that of a carbide acetylene plant for the same acetylene capacity. One authoritative source is quoted as suggesting that a 100-million-lb. per year carbide acetylene plant costs approximately \$10 million with all facilities as against \$20 million for a similar capacity petrochemical acetylene plant.

In the US, of course, acetylene from natural gas has received greater attention than the carbide process, yet carbide acetylene appears to have accounted for 80 per cent of all acetylene produced last year.

Cost and process competition from other hydrocarbon chemical raw materials are seen as showing acetylene's rapid growth. Also the need for an acetylene manufacturing process complete with safe handling techniques is stressed by some. US industry sources are stated to look to Europe as a continuing source of significant numbers of new chemicals made from acetylene, new processes to make known products using acetylene, and process improvements for making acetylene.

### RUMANIAN CHEMICAL INDUSTRY

METHANE gas is a very valuable raw material for the Rumanian chemical industry and according to the latest information bulletin of the Rumanian Chamber of Commerce, there are great development possibilities for it.

Rumania is the fourth country in the world to extract methane. A notable feature of the gas is its high order of purity; deposits now being worked are stated to be 99.5 to 99.8 per cent pure methane.

Methane has been used by the Rumanian chemical industry for more than 20 years. In fact, Rumania was one of the few countries to use the gas in the manufacture of carbon black and synthetic ammonia.

At present, among the most important products made from methane is carbon black, which is produced in all three types, i.e. furnace, channel and dissociation carbon black. An increase in output capacity of carbon black is envisaged.

New ammonia synthesis plants have been set up in Rumania in recent years, and construction has now begun of a large fertiliser factory which is to have an output of 100,000 tons of nitrogen fertilisers a year.

In addition to the products required in the agricultural industry, Rumania's chemical industry is producing formaldehyde and urea from methane for the growing plastics industry. In the first years of the second five-year-plan, a number of projects were begun with a view to developing the plastics sector which by the end of 1960 is to increase production fivefold.

The possibility of obtaining acetylene from methane has been under investigation for some time and in the last two to three years this research has led to the construction of two plants for manufacturing acetylene by electric cracking and by partial oxidation. These two plants, where technical testing, it is understood, is already being carried out, are to produce acetone, acetic acid, acetaldehyde, polyvinyl acetate and pentaerythritol.

With a view to further developing research into the use of methane as a raw material for the chemical industry, a research institute—the Chimigaz—has been set up. Research workers at the institute are reported as already having perfected methods for the manufacture of cyanic acid, a raw material used in producing synthetic fibres and plastics, of synthesis gas for producing formic acid, of halogenated methane derivatives used as solvents.

In this research and in plant design and construction of new industrial units, Rumania keeps in close touch with the Soviet Union, Hungary and Eastern Germany.

# GEC Open Laboratories For Beryllium Research

## Possible Fuel-canning Material

RESEARCH on the metallurgy and technology of beryllium will be carried out in a new laboratory opened recently by the General Electric Co. Ltd. at their atomic energy division, Erith, Kent.

To be entirely devoted to beryllium, the laboratory has been specially designed for this kind of work. Because of beryllium's toxic properties, its construction, layout, equipment and elaborate ventilation system have been planned to ensure the maintenance of high standards of safety.

Considerable assistance was provided by the UK Atomic Energy Authority during the design of this laboratory.

Studies of the chemical and physical properties of beryllium metal in fabricated form will be made in the laboratory. The first stages of the programme are largely concerned with investigations on mechanical properties at elevated temperatures and with measurements of oxidation resistance in carbon dioxide.

One of the major disadvantages of beryllium is its brittleness, and GEC intend to pay particular attention to this aspect. Equipment for carrying out creep and stress-rupture investigations is at present being installed. Further subjects for future study include the welding of beryllium and the examination of the effects of aqueous corrosion.

### Low Neutron-absorption

Beryllium possesses properties which recommend it as a possible fuel-canning material for use in gas-cooled nuclear reactors. It has a very low neutron-absorption cross-section; its melting point (1280°C) is considerably higher than that of other metals already used for this duty; its resistance to oxidation is good both in wet and in dry carbon dioxide; and its high-temperature strength is excellent.

Current information suggests that a beryllium fuel-can could probably be operated at temperatures of about 600°C. This would permit the maximum gas temperatures at the outlets from the reactor to be raised by at least 100°C above the level possible in current designs.

Methods of eliminating the hazards arising from the metal's toxicity have been thoroughly investigated by interested authorities both in the UK and in the US, and, as a result, a number of recommendations have been made. The principal feature in the standards adopted by the UKAEA and applied in the design of the new laboratory, is the necessity of obtaining a working atmosphere where the average atmospheric concentration of beryllium does not exceed 2 millionths of a gramme per cubic metre throughout the working day.

Considerable care must be devoted to each operation involving beryllium and

special techniques may be required in particular cases. For example, dusty operations such as grinding require more precautions and protective installation than some other, non-abrasive, operations.

The laboratory is a two-storey brick building with a concrete roof. For all normal purposes, the only means of entry is through a change room which is divided into two parts separated by a barrier. On the entry side of this barrier, all personal clothing is left in lockers, while on the contact side complete laboratory clothing is provided. In addition, there are washing facilities and a shower.

The laboratory itself is divided into two areas, A and B. The A area is designed for operations of greater potential hazard, and has a higher air-extraction rate than B. Double emergency doors open out of the building from laboratory area B and these, though normally sealed, are also used where necessary for the introduction of plant and machinery.

The first floor houses the service room and the extract-filter room, and also provides some office and laboratory accommodation for the medical radiobiology department.

The walls and ceiling are finished in a high-gloss paint, to facilitate cleaning, and efforts have been made to keep the laboratory free from dust traps. All the electric wiring is buried beneath the plaster, and all switches and sockets are flush fitting. The light shades are sealed to the ceiling.

The floor is covered with heavy-gauge linoleum, coved to the walls, and contains twenty-five drain points. Liquid effluent is discharged to a 400-gallon inspection and holding tank, which can be monitored.

Since much experimental work is to be carried out in a pressurised carbon dioxide atmosphere, a supply of this gas is piped round the laboratory at a pressure of 150 p.s.i.g. A normal supply of compressed air is available but, in addition, a separate compressor is installed to provide a low-pressure, clean air supply for air masks and pressurised suits.

The laboratory areas are completely

air-conditioned by means of one central inlet air duct, and two ranges of extract ducting which run along the laboratory walls at ceiling height.

A fan having a capacity of 6,000 cu. ft./min. draws air into the building through a bank of filters followed by a steam-to-air heat-exchanger thermostatically controlled to maintain an inlet-air temperature of 75°F.

The extract system is more complex. It consists basically of a fan drawing air at the rate of 8,000 cu. ft./min. from the laboratory, through twelve Vokes absolute filters.

The quantity of air extracted from the laboratory is greater than that admitted through the inlet manifolds. This ensures that a slight negative pressure is created in the laboratory, so that air leakage can only occur into the building.

Initially, all experimental procedures involving the handling of beryllium will be carried out in ventilated working-boxes, each designed around a specific operation.

It is essential, if all risks of beryllium poisoning are to be completely avoided, for each laboratory operation to be proved safe before it is allowed to be conducted on a routine basis. Therefore, while a complete change of clothing followed by a shower at the end of the day is obligatory even for normal work in the laboratory, each new operation is initially performed in fully protective clothing with an external air line.

Using this procedure, the operation in question can be carried out while air samples are taken at a number of points in the immediate vicinity of the operator.

Beryllium monitoring is difficult, and, at present, the use of spectrochemical techniques on a batch-sampling basis provides the best safeguard. In collaboration with the GEC research laboratories at Wembley, a sampling and analytical scheme has been established using air samples of about 10 cubic metres. By the methods employed, as little as 0.015 millionths of a gramme of beryllium can be detected.

In addition to air monitoring on specific operations, routine background samples are taken daily in the laboratory over a period of eight hours.

A fireproof safe is used as a store in which all beryllium is kept when not in use and when the laboratory is closed.

The disposal of solid waste contaminated with beryllium will be carried out in the manner adopted by the UKAEA, e.g. by burial in sealed containers.

Left: Metallography box in laboratory A with an air-sampling operation in progress. Part of laboratory B can be seen through the partition





★ A SULPHURIC acid plant in a kalaedioscope of colour was the unusual sight that greeted me when I visited the new SAI fertiliser plant at Leith last week. Red, beige, green, silver, yellow and two shades of blue had been used on various sections of the plant. This was obviously the influence of the architects, Basil Spence and Partners, who also advised on the external features and how they could best blend in with the general scheme.

I discovered that there was no code in the colours used, merely a noble attempt to brighten up what is normally a somewhat drab piece of chemical engineering. The effect, as seen through swirling snowflakes was most effective. Another interesting use of colour was to break into squares the treatment of large perpendicular walls.

The futuristic storehouse and almost graceful treatment of the conveyor system, make this plant a noteworthy one. The more mundane technical details are dealt with elsewhere in this issue!

★ NEWLY designed containers of polythene and hardboard that are now being made by Charles H. Windschuegl Ltd., London EC3, for supplies of their formic acid, are interesting on a number of counts. First is their second-hand value. When empty they can be washed and used as a container for other kinds of liquid, including corrosives. Users of formic acid, who are themselves producers of liquid products, can, therefore, make use of these containers.

Holding 35 kilos each, these polythene 'jerricans', described as virtually indestructible, will be used by Windschuegl for acid consigned to most overseas destinations. Designed for easier stacking and handling, the containers can result in a lower c.i.f. cost where freight rates are based on cubic measurements. These reductions and a reduced insurance risk is said to more than offset the extra cost of the containers.

★ THE idea formed by many that coal, oil and nuclear power are in competition as fuels and are seeking to 'oust' one another is wrong. In terms of attempting constantly to improve their efficiency they are, very properly, competitive but the demand for power, whatever its source, is rising all the time.

There are many examples of the very real partnership of coal, oil, and nuclear energy. The coal industry is a large consumer of lubricants. The nuclear-powered super-tanker is much nearer to reality than many realise. Atomic power stations need ordinary and highly specialised lubricants.

By the same token it is wrong to ignore the progress being made by the coal industry in finding new methods of making

more economical use of its products. As one example, £10 million has been spent on building a new coking plant near Chesterfield which wastes nothing, not even its own smoke. Writing in the *BP Magazine* for February, Mr. J. B. White says that handling 2,000 tons of raw coal a day, the plant produces coke, benzole, tar, gas, ammonia, pitch and other chemicals besides 27 million cu. ft. of gas a day, 60 per cent of which goes to the Gas Board's grid.

★ A RESOLUTION to be put forward at the Co-operative Party's annual conference at Hastings from 4 to 7 April underlines public disquiet at the growing use of chemical fertilisers and food additives. The resolution states:

'That this annual conference is of the opinion that the increasing use of fertilisers and additives for all phases of food production requires to be regulated in the interests of the health of consumers. Conference therefore requests the national committee to examine and report upon the matter with a view to the introduction of legislation beneficial to consumers.'

At first this just appears as obscurantism on the part of the Co-operative Party. But is it? Most people are quite naturally opposed to any adulteration of their food and must be persuaded that the additives are not only for the good but are essential if our modern, overcrowded civilisation is to survive.

Chemical fertilisers are now accepted by most farmers and by the general public and much of the credit for this must go to the manufacturers who have conducted a long publicity campaign. Food additives, however, still have a bad reputation and by their very nature cannot be easily publicised in particular applications. However, Governments and industry are alive to the problem as was demonstrated at the conference on Chemical Additives in Food held in London last July (see *CHEMICAL AGE*, 3 August, p. 171 and 10 August, p. 209).

There is a case for a widespread dissemination of knowledge on this subject by independent bodies such as Government departments and the World Health Organisation.

★ ONE of the most lavish booklets to come my way is 'A career in chemicals', which arrived on my desk this week from the Shell Chemical Co. Ltd. Based on the belief that a company, like a nation, is judged by the individuals who represent it, the booklet outlines career opportunities by featuring short biographies, mostly of younger people who have joined Shell within the last few years.

The booklet clearly shows that youth is no bar to high position and that for many

of the company's scientists and executives there are opportunities for travel. Dr. Gordon Swift, at 34 head of the surface coatings and solvents laboratory, Egham, has visited the US, the Dutch research headquarters of the Royal Dutch Shell group, and other Shell companies in Europe. From 1943-46 Dr. Swift worked on the commercial utilisation of the hitherto unused polysaccharide, Dextran.

Mr. T. B. McLaren, 35 years old, joined Shell in 1947 and is now working at Mekog before taking up his post as departmental manager of the nitric acid and Nitra-Shell plant at Shell Haven. Miss Thelma Berry, aged 26, who was attracted by the prospects of service abroad, joined the technological department on the Stanlow chemical plant in 1956. She went to King's College London in 1953 to take a Ph.D. course; her thesis on 'Photo-chemical decomposition of alkyl nitrates' is still unfinished.

Mr. Sydney Muller, who at 40, is chief technologist of Petrochemicals Ltd., joined that company in 1949 and has visited the US to study synthetic rubber production by the Shell Chemical Corporation.

★ My apologies to Mr. W. R. Luscombe, assistant chemical executive with W. J. Bush and Co. Ltd., for a mistake in reporting his anti-freeze solution for 'do-it-yourself' enthusiasts. Mr. Luscombe's main recommendation was that the anti-freeze should be retained in the system throughout the year to afford corrosion protection during the summer and not that it should be emptied as I suggested on 15 February.

If the anti-freeze is removed at the end of the winter, corrosion inhibitors should be added to the water used. Either practice is preferable to the present widespread use of uninhibited water during the summer, when much corrosion must occur in car cooling systems.

★ THE production of food from algae, the subject of war-time experiments in several countries, is in the news again. From UNESCO I learn that the Japanese Chlorella Research Institute has started mass production of a new foodstuff from chlorella, an algae that grows in ponds. It is being cultivated in four pools specially constructed in Tokyo and will be produced in both liquid and powder form.

Chlorella is claimed to be highly nutritive and cheap to produce. The advantage of chlorella over other plants is that it can use more light energy than crops occupying the same area and is said to be unaffected by adverse weather conditions.

Despite all these advantages, I remain a sceptic where food from algae is concerned. As was the case with some of the wartime experiments, great claims are made for the nutritional value of the product, but nothing is said about its smell or palatability, decisive factors in my mind.

Alembic

# SUCCESSFUL OCCA EXHIBITION

## Overseas Visitors Predominate at Colour Chemists' Show

ATTENDANCE figures for the OCCA exhibition, which closed on 13 March, were about the same as last year's, over 5,000 in the three days. Many more visitors from overseas visited the stands, and exhibitors are reported to be very satisfied with the results of the exhibition.

Among the interesting exhibits at the Royal Horticultural Hall not included in our preview (see CHEMICAL AGE, 8 March, page 455) was the apparatus on the Dunlop Composition Division stand, designed to ascertain the stability characteristics of their polyethyl acrylate emulsion 751. It is an ultrasonic sedimentation tester or quartz oscillator, which by submitting the emulsion to a series of high energy vibrations of about 650 kilocycles a second, demonstrates how its formulation is deduced and how the stability characteristics of experimental emulsions in general are determined.

A series of polyvinyl alcohol resins known as Gelvatol were shown by Shawinigan Ltd., Lloyd's Avenue, London EC3. Grades varying from a 55-65 viscosity resin with a residual p.v.a. percentage of 0.2, to a 1.3-2 viscosity resin with 37-42 per cent residual p.v.a. The completely hydrolysed types, those with one per cent acetate, are dissolved in water at a minimum temperature of 85°C. The medium acetate-content Gelvatols are added to cold water with stirring; heat is then applied to speed solution.

Applications of Gelvatol are based on the water-solubility, adhesive properties and resistance to most organic solvents of the resin, as well as the tensile strength of Gelvatol films. They are considered suitable as stabilisers for waxes and oils as well as p.v.a. emulsions, for paper coating, textile sizing and finishing, as solvent resisting films, adhesives, photosensitive coatings and, plasticised, for moulding.

New uses for octylphenol, an alkylated phenol manufactured by Imperial Chemical Industries Ltd., were shown. Octylphenol has proved of value as an intermediate for surface coating resins. When octylphenol resins are compounded with tung oil, the company claim, the oil-soluble resin varnishes give films lighter in colour, with greater colour stability, more rapid-drying qualities and are tougher and less brittle than modified phenol-formaldehyde varnishes. They also have a good resistance to water and dilute alkali. These varnishes find their main use in exterior finishes where high performance is required, in spar varnishes and marine paints, for example. The coatings also have good electrical properties, and insulating varnishes for fabric coatings can be formulated. Varnishes made with octylphenol-formaldehyde resin and tung oil may be used to upgrade cheaper varnishes and the water resistance of alkyd resins can be increased

by blending the alkyds with short tung oil varnishes derived from octylphenol-formaldehyde resins.

Methyl ethyl ketone peroxide (high activity), was amongst the newer peroxy compounds on show by Laporte Chemicals Ltd. MEKP (HA) is a water-white liquid consisting of a minimum of 50 per cent of a mixture of peroxides in solution in dimethyl phthalate. It is insoluble in water, slightly soluble in petrol solvents and soluble in oxygenated organic solvents. It is stable at normal temperatures but above 40°C it begins to decompose with the evolution of gas at a rate which increases with the rise in temperature.

Like standard MEKP 60 per cent, MEKP (HA) is an active source of free radicals but a difference in chemical constitution results in greater reactivity when used at low temperatures with metal activators in some applications. It can also be used without activators in higher temperature applications, but in this case it

is usually less reactive than standard MEKP 60 per cent.

Results of tests carried out by Shell Chemical Co. Ltd. on silicone-modified Epikote resins were shown at the exhibition. The intermediate investigated was MS 650 (Midland Silicones Ltd.) a methoxypolysiloxane prepared from alkyl, phenol and monophenyl substituted organosilicon intermediates. Epikote 1001 was prepared with the silicone product in a ratio of 100/20, and a varnish made up from the modified resin. Two coats of the varnish were applied to grit blasted steel panels and hardened for seven days, together with an orthodox Epikote varnish formulation. It was found that after two weeks immersion in distilled water the unmodified Epikote showed signs of very slight blistering and rusting, and after six weeks of immersion, severe blistering and rusting. The silicone-modified Epikote resin, however, was unaffected after two weeks immersion, with only very slight whitening of the film after six weeks, and slight blistering and rusting after ten weeks.

The compatibility of drying oils with Vinamul copolymer emulsions was featured on the stand of Vinyl Products



At the OCCA Exhibition, London. I. to r.: TOP LEFT. Examining a model of a new heat exchanger unit installed at the new plant of A. Boake, Roberts Ltd., Widnes, are Dr. J. V. Evans, product development chemist, Sig. B. Franc, Max Meyer Co., Milan, Italy, Dr. H. W. Talen, Paint Research Institute, Delft, Holland, and Mr. I. R. Hayward of industrial chemical sales. TOP RIGHT. A new stand/hand laboratory mixer with a new type control being demonstrated by Mr. P. M. Davison of L. A. Mitchell Ltd. BOTTOM LEFT. Looking at a demonstration of heat resisting finishes based on polymeric butyl titanate on the stand of Laporte Titanium Ltd. are Mr. J. T. Richmond, director and chief chemist, and Mr. J. Taylor, technical service manager. BOTTOM RIGHT. An electron micrograph on the British Titan Products Ltd. stand being examined by Mr. M. Hess, senior chemist of Mander Bros. Ltd. Wolverhampton, and Mr. A. D. Hibberd, technical sales manager.



L. to r. LEFT. On the stand of Armour and Co. Ltd., examining samples of the new cationic chemicals, shown for the first time in Europe, are Mr. P. Leicester, an executive of Shell Chemical Co. Ltd., and Mr. M. K. Schwitzer, manager of the chemical division. RIGHT. The British Oxygen Chemicals Ltd. stand with Dr. R. F. Goldstein, managing director, Dr. R. J. Morley, director-general, carbonisation, National Coal Board, and Dr. J. W. Haworth, chemical products manager, British Oxygen Research and Development Ltd.

Ltd., Butter Hill, Carshalton, Surrey. The linseed oil tolerances of vinyl acetate, vinyl caprate and vinyl acetate-vinyl stearate copolymers were determined for copolymers of varying monomer ratios and plotted against the average number of carbon atoms in the polymer side chain. The vinyl acetate caprate copolymers showed a maximum tolerance to linseed oil when the average number of carbon atoms is about 4, i.e. at a vinyl acetate/vinyl caprate ratio of 55/45 by weight. Tests with other drying oils follow a similar pattern to linseed oil. The tolerances of the vinyl acetate-vinyl caprate copolymers to tung oil and dehydrated castor oil were compared with those of linseed oil, and results indicated that the drying oil tolerance of vinyl acetate-vinyl caprate copolymers varies with the drying oil.

The company consider that there is a definite relationship between drying oil compatibility and the average number of carbon atoms in the polymer side chains.

Surcoprene rubber hydrocarbon resins were featured on the stand of **Surface Coating Synthetics Ltd.** Surcoprene is made in two basic grades, the low viscosity type represented by Surcoprene 1000, the pale grade, and its darker counterpart Surcoprene 1100. The other two rubber hydrocarbon resins are the high viscosity Surcoprene 1050 and the darker 1150. Recent tests have been carried out on these products as an additive to conventional media in flat wall paints and wall primers and in rubberised paints.

**Research Equipment (London) Ltd.**, Wellington Road, Hampton Hill, Middlesex, exhibited two new pieces of equipment, the 'Rel' senior salt spray cabinet and the 'Rel' multi-head abrasion test apparatus, both physical testing apparatus.

The salt spraying cabinet is manufactured completely in acrylic material and has external dimension of 36 in. by 22 in. by 10 in. Constructed in a similar manner to the Junior cabinet, it is fitted with two high-pressure sprays each consuming 1½ cubic ft. free air per minute at 20 lb. a square inch. The cabinets can also be

supplied with internal heater and modified for use with sulphur dioxide.

The multi-head abrasion test apparatus has been designed to test six panels simultaneously. They are ranged in two banks of three and each bank can either be tested wet or dry. This equipment is

## WELDING 139-FT.-LONG NITRIC ACID ABSORPTION TOWER

A NITRIC acid absorption tower now in service at the Wilton works of ICI Ltd., is said to be one of the largest stainless steel vessels ever to be welded. Weighing 93 tons, it has an overall length of 139 ft. and a diameter of 15 ft. It was fabricated by Ashmore, Benson, Pease and Co. Stockton-on-Tees, and the material used throughout was 18/18/1 austenitic steel. The shell was made in three distinct sections of differing plate thicknesses.

For the lower part, measuring 14 ft. 9 in., material of  $\frac{1}{2}$  in. thickness was used: the centre and the remainder was of  $\frac{3}{8}$  in. thick material. The hemisphere forming one end (this became the top of the vessel when vertically erected) was also in  $\frac{1}{2}$  in. thick material and was constructed from 12 segments and a crown. The hemisphere for the other end was constructed in similar fashion to the top hemisphere but with 10 segments and a crown. The thickness of material used was  $\frac{1}{2}$  in. and both ends were therefore of the same thickness of material as the section of shell to which they were joined. The supporting base rings and skirt were in  $1\frac{1}{2}$  in. and  $\frac{3}{8}$  in. thick material respectively.

Fusarc automatic machines, using continuous Staymec No. 1 electrode, were used for the automatic welding of the vessel. Fabrication was carried out in a series of sub-assemblies approximately 15 ft. long, in order to make the fullest use of the internal welding boom for automatically welding the internal seams. For external welding, a Fusarc welding head mounted on a universal type of cantilever was employed and beneath this the vessel was mounted on a heavy series roller bed,

supplied complete with rubber pads and clamps for nylon twill, and nylon-filled brushes.

### Reagent for Cobalt and Iron

NITROSO-R-SALT, a reagent for cobalt and iron, is described in a monograph issued by Hopkin and Williams Ltd., Freshwater Road, Chadwell Heath, Essex. Nitroso-R-salt is a yellow powder, soluble in water, acids and alkalis.

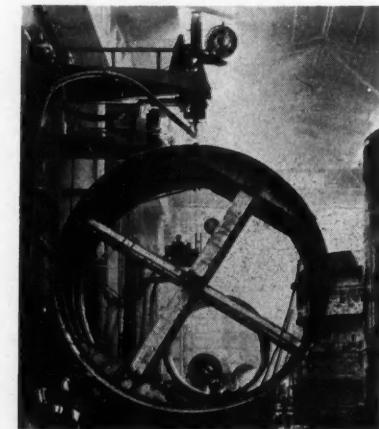
In neutral or alkaline solution the reagent combines with cobalt ions to give a deep red complex which is not destroyed by acidification. This colour reaction is selective and the intensity of the complex alters only slightly over a period of eight hours.

With ferrous iron in an acetate-buffered solution the reagent reacts to produce a green coloured complex which is stable for at least 24 hours, even in the absence of excess reagent.

The method is stated to be more selective than the 1:10-phenanthroline and 2:2'-dipyridyl methods and to circumvent the interference common to both. The coloured complex obeys Beer's law over its entire useful range.

being rotated for the circumferential seams and traversed for the longitudinal seams.

In the fabrication of large diameter vessels such as this column, a spider form of internal stiffening is usually fitted to maintain circularity of the vessel. In this case, however, other means had to be adopted so that the internal welding boom could be used. External stiffening rings were therefore used to maintain concentricity while the welding was in progress.



One of the largest stainless steel vessels ever welded has been erected at the ICI Wilton works. It was fabricated by Ashmore, Benson, Pease and Co. with the aid of Quasi-Arc welding equipment. Our picture shows one of the strakes being welded on a roller bed.

## SAI'S NEW FERTILISER



### Sir Alexander Fleck Opens Plant for Concentrated Complete Fertiliser

THE new £3-million fertiliser plant of Scottish Agricultural Industries Ltd., opened by Sir Alexander Fleck, ICI chairman, on 17 March at Leith, brings to the functional techniques of a modern factory the aesthetic genius of one of this country's leading architects. Basil Spence and Partners were the consulting architects for the administrative block, including offices, laboratory, canteen, cloakrooms, as well as the process control buildings, and their advice was sought on the external features of the production, handling and storage facilities. Their influence can be seen in the general view of the plant shown above.

Main architectural features of the works, built on reclaimed land at Leith docks, are a vast 900 ft. long by 100 ft. wide materials store and a conveyor system which starts underground on the quay side and soars over the works in asbestos-clad tubular steel gantries on precast concrete legs.

The three main plants are a Simon-Carves-Monsanto sulphuric acid unit (175 tons a day capacity), a Prayon phosphoric acid unit (66 tons P<sub>2</sub>O<sub>5</sub> a day), and the third unit in which phosphoric acid is neutralised and compounded to produce ammonium phosphate based granular NPK fertilisers (150,000-tons-a-year capacity). This section was designed by Dorr-Oliver Inc., and constructed by Simon-Carves.

The first unit to be brought into operation was the sulphur-burning contact plant, the largest of its kind in Scotland. It came on stream in July 1956, having taken 16 months to complete from the design stage. The phosphoric acid plant was designed by Engineering and Industrial Corporation SA, Luxembourg, to produce acid at a strength of 32 per cent P<sub>2</sub>O<sub>5</sub>.

Much of the structural work has been carried out in reinforced concrete because

of its resistance to chemicals. Ammonia storage tanks, for both synthetic and by-product, and the phosphoric acid building are in this material.

The new works, by far the largest ever undertaken by SAI, have replaced the former plant at Salamander Street, Leith, which is now to be used as a store for finished fertiliser and it will also house the bagging machines. Since the war, the company has carried out a series of modernisation schemes in many of its works. These changes enabled production costs to be kept down and improvements to be made in quality, as well as ensuring that supply met demand.

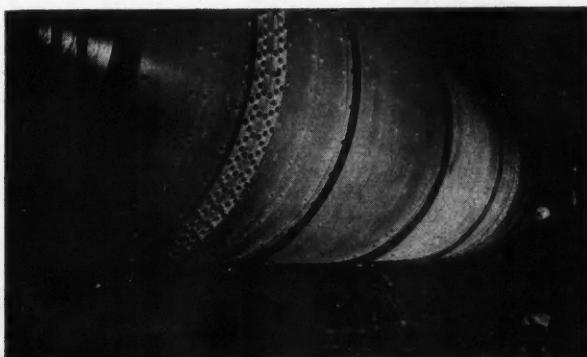
When the question of reorganising the Leith works arose, a careful survey of the Scottish fertiliser position showed that something more than modernisation was called for. The time had come to change from the traditional types of superphosphate based compound fertiliser to more concentrated products, easier and cheaper to transport, to store and to handle.

After studying methods of attaining greater concentration including triple-

superphosphate, nitro, alkali and electro-thermal phosphates, it was decided to use the ammonium phosphate route. There was little difference in cost compared with the old route and it gave a much greater concentration. It also gave a very versatile fertiliser, known as CCF (concentrated complete fertiliser). The only other UK plant using this route is that of ICI Ltd., who have employed it at Billingham for more than 30 years. There are other plants in Canada and the US.

Having decided on the route, the company searched the world for the best processes. So far as the sulphuric acid was concerned, a Monsanto contact plant was chosen. It has been constructed by Simon-Carves to be convertible to pyrites-burning should sulphur become either scarce or uneconomic. The Prayon route to phosphoric acid with its highly efficient filter system was selected.

The works at present occupy 19 acres of land reclaimed from the Firth of Forth; SAI will take over a larger area when the Leith Dock Commission complete a new sea wall. There is plenty of room for further development and a start has already been made by the construction of a plant for the production of an industrial grade of monammonium phosphate for which there is a large demand for fire-proofing purposes.



The 90-ft. long drier in the granulation plant

## SULPHURIC ACID PLANT HAS DAILY CAPACITY OF 175 TONS

THE Simon-Carves-Monsanto sulphuric acid plant installed at Leith has a daily capacity of 175 tons of  $H_2SO_4$ . There is no surplus, all the production being utilised by SAI. Sulphur is stored in a section of the main raw material storage shed, screened from the phosphate section since fluorine from phosphate rock would seriously affect the Monsanto vanadium catalyst in the converter. (Catalyst capacity is 31,500 litres, equivalent to 180 litres catalyst per ton of  $H_2SO_4$  per day).

Sulphur is melted in an underground brick-lined pit, the molten sulphur overflowing into a sulphur tank from which it is pumped through a Kelly pressure filter to a clean sulphur storage pit. Ash, down to a level of 0.5 per cent, and some of the bitumen in darker grades of sulphur are removed. In the burner, the molten sulphur is burned in a stream of pre-heated air to  $SO_2$  of around 7.5 per cent concentration. A total of 60 tons of sulphur is burned per day. So far SAI have used Texas Gulf sulphur, Freeport, Mexican and Government surplus. The aim is to find the type most suited to the process.

The air for combustion is dried by passing through a steel tower packed with ceramic rings and irrigated with 94 per cent sulphuric acid. The temperature of the gases leaving the burner is reduced from around  $980^{\circ}C$  to  $400^{\circ}C$  by passage through a waste heat boiler, operated at 360 p.s.i. with elements of the Foster-Wheeler type. Steam from this boiler is sufficient to provide for the motive power for the turbo-blower forcing the gases through the plant and also for generating power in a 300 kW turbo-generator. The low pressure steam from these units is

normally sufficient for the factory demand for heating and process use.

The gases from the boiler are passed into a hot gas filter filled with graded quartz to remove any suspended matter before reaching the converter. Conversion to  $SO_3$  is accomplished by passage through four catalyst beds contained in a single converter vessel.

The gases leave the converter at around  $410^{\circ}C$ , to enter a boiler feed water economiser. From here the gases pass through an  $SO_3$  cooler—a vertical tube and shell heat exchanger where the temperature is controlled to around  $180^{\circ}C$  to  $200^{\circ}C$  for absorption. Absorption takes place in a steel tower packed with ceramic rings over which 98.5 per cent sulphuric acid is circulated. The gases leaving the absorption tower have an acid content of around 1.7 grains of  $SO_3$  per cu. ft. and are discharged direct to atmosphere through a 150 ft. steel chimney.

### Needle-tube Coolers

The acid, circulated over drying and absorption towers, passes through banks of cast iron Newton Chambers needle-tube coolers over which sea-water is passed to dissipate the heat generated in one case by drying the air and absorbing moisture in 94 per cent  $H_2SO_4$  and in the other case by the absorption of  $SO_3$  in 98.5 per cent  $H_2SO_4$  and subsequent redilution to 98.5 per cent  $H_2SO_4$ . This cooling system is used in this country at only one other plant, that at Grimsby of British Titan Products Ltd.

Storage is provided for 3,900 tons  $H_2SO_4$  in three mild steel tanks of welded construction.

### Prayon Process Used For Production Of Phosphoric Acid

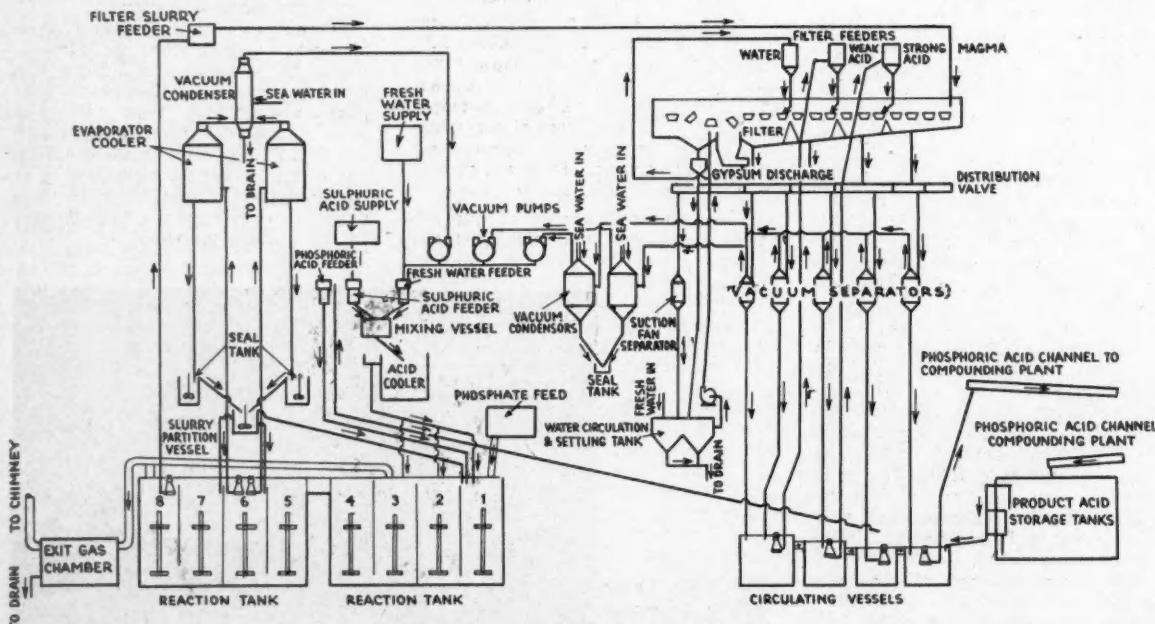
THE wet process for phosphoric acid manufacture is used, involving the reaction between sulphuric acid and phosphate rock, giving calcium sulphate and phosphoric acid. It involves the removal, by filtration, of calcium sulphate as gypsum, from suspension in the phosphoric acid.

The plant at Leith is a Prayon plant designed by the Engineering and Industrial Corporation, Luxembourg. Daily capacity is 60 tons of  $PO_4$ . The two large reaction vessels are constructed in steel and lined with rubber and carbon brick. The hot magma containing  $H_2SO_4$ ,  $H_3PO_4$  and traces of HF and possibly  $HCl$  is extremely corrosive. Each of the vessels is divided into four compartments.

Phosphate rock is fed through a crusher into an air-swept Bradley Poite mill. This mill is fed by a Simon weigh-belt feeder providing a steady and controllable flow of phosphate through the mill to the reaction tanks. Into the reaction tanks are also fed sulphuric acid and dilution water metered from constant head tanks by flow through nozzles of known aperture, and weak phosphoric acid from the filtration section. The points in the reaction system at which these materials are fed can have a considerable effect on the rate of reaction and filterability of the gypsum produced. Arrangements are made, therefore, to vary the additions to give the best results under various plant conditions.

In general, the reaction takes place mostly in the first half of the attacking system, the second section serving mainly to age the magma and produce the gyp-

(Continued on page 542)

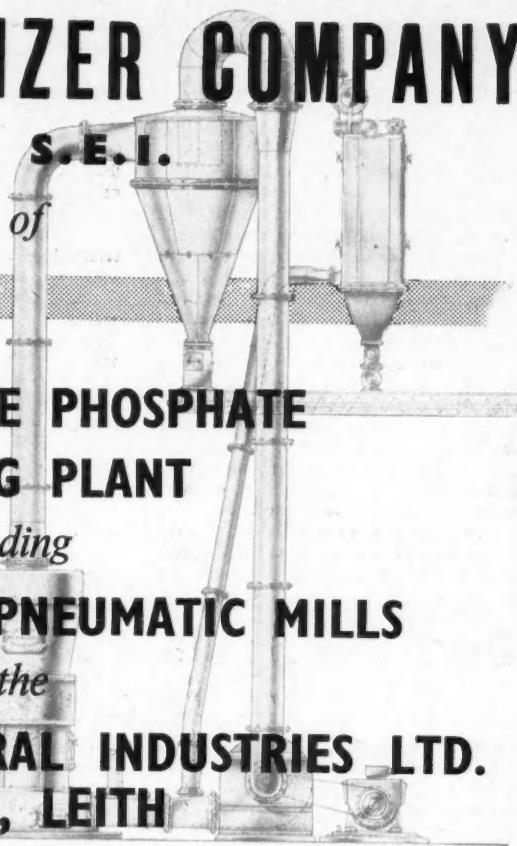


Simplified flow diagram for phosphoric acid plant

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sum slurry in an easily filterable form. The magma is kept in fairly vigorous movement by agitation and by circulation round the series of reaction compartments. The recycle of magma passes from the sixth reaction compartment to the first through two evaporative coolers which provide temperature control in the system. A proportion of the magma, equivalent to the intake of phosphate rock, sulphuric acid and recycled dilute phosphoric acid is pumped from the last reaction compartment to the Prayon filter.

The filter is one of the most important units in this plant as the strength of the phosphoric acid produced and the efficiency of recovery obtained largely depend on efficient filtration and washing.

The Prayon filter consists of a number of trays forming sections of an annular ring which rotates horizontally, bringing each tray or cell in turn into position for the various washing and filtration operations. The trays are of stainless steel and the cloths of synthetic fibre, supported by a perforated rubber backing.

The cycle is as follows: Magma is fed on to the tray and the strong phosphoric acid filtered off under vacuum and fed to the product acid storage tanks. The

tray passes to the first of three successive washes where the cake is washed under vacuum. The wash liquors are re-cycled, the weak phosphoric acid from the water wash being used for the second wash and the rather stronger acid from this wash used for the first wash. The acid from the first wash, which contains about 26 per cent  $P_2O_5$ , is re-cycled to the attacking system. After passing through the water wash, the tray is tilted and the cake of gypsum, washed virtually free from soluble phosphate, falls into the gypsum disposal mixer screw, where it is slurried with sea-water and fed into the main out-fall drain.

Phosphoric acid is extremely corrosive and rubber and special grades of stainless steel are largely used. The attacking tanks are lined with rubber and carbon brick set in cashew nut shell cement and the launders carrying the magma between vessels are of stainless steel. Pipe lines and troughs carrying magma and product acid are, whenever possible, flexible armoured rubber as it is much easier to remove the scale of calcium sulphate and fluosilicates which normally gathers from this type of piping. Storage tanks for the product acid are of mild steel lined with rubber.

Steam at 10 p.s.i. is applied to the external heat body fitted with carbon tubes in tube sheets of homogeneously lead-covered steel. The flash chamber, vapour piping, liquor piping and condenser are of rubber-lined steel. The condenser uses sea-water and the vacuum is produced by a two-stage steam jet ejector with an inter-condenser between the stages. The acid is pumped at relatively high liquor circulation rates through the evaporator, giving an acid concentration range on each pass of 1 or 2 per cent  $P_2O_5$ . The evaporated acid is discharged through a sealed barometric leg to the evaporator agitator tank to which is added the weak acid feed. The make is bled off from this tank. The strength of acid produced is regulated by evaporator temperature.

Using the process described above, the precipitation of gypsum and fluosilicates which would otherwise deposit inside the evaporator is minimised because the small increase in concentration does not raise the super-saturation excessively and the residence time in the evaporator is short. As the super-saturation is rather limited and the hold up in the evaporation acid agitator is comparatively long, this supersaturation is discharged in the agitator.

There is, however, some deposition in the pipe lines between the various parts of this plant, and a duplicate set of lines is provided so that a washing procedure can be carried out on one set while the other set is in operation. Condensed steam from the evaporator flash chamber and sea-water from the condenser leave the system through sealing legs and empty into a hot well which discharges to the main effluent drain. Condensate from the evaporator heat body and its steam trap is returned to the boiler plant.

Water from the inter-condenser and the washings from the plant empty into a wash water tank. Some of the liquor from the wash water tank is pumped as feed water to the fume scrubber which

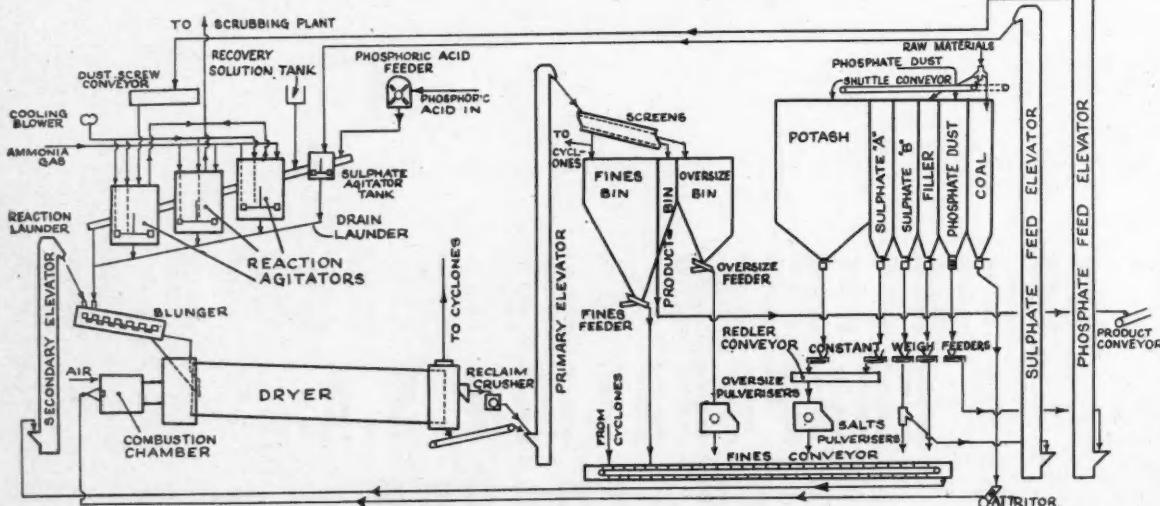
(Continued on page 544)

# Dorr-Oliver Plant for Production of Fertilisers

THE plant for the manufacture of ammonium phosphate-based granular NPK fertilisers was designed by Dorr-Oliver, Inc., Stamford, US, and constructed by Simon-Carves. Phosphoric acid is neutralised by a stream of ammonia gas which is distilled from synthetic or by-product liquor brought into the factory. The resultant slurry of ammonium phosphate is added to sulphate of ammonia and muriate of potash in the proportions to give the required ratios of nitrogen, phosphate and potash. Granulation is effected by mixing the am-

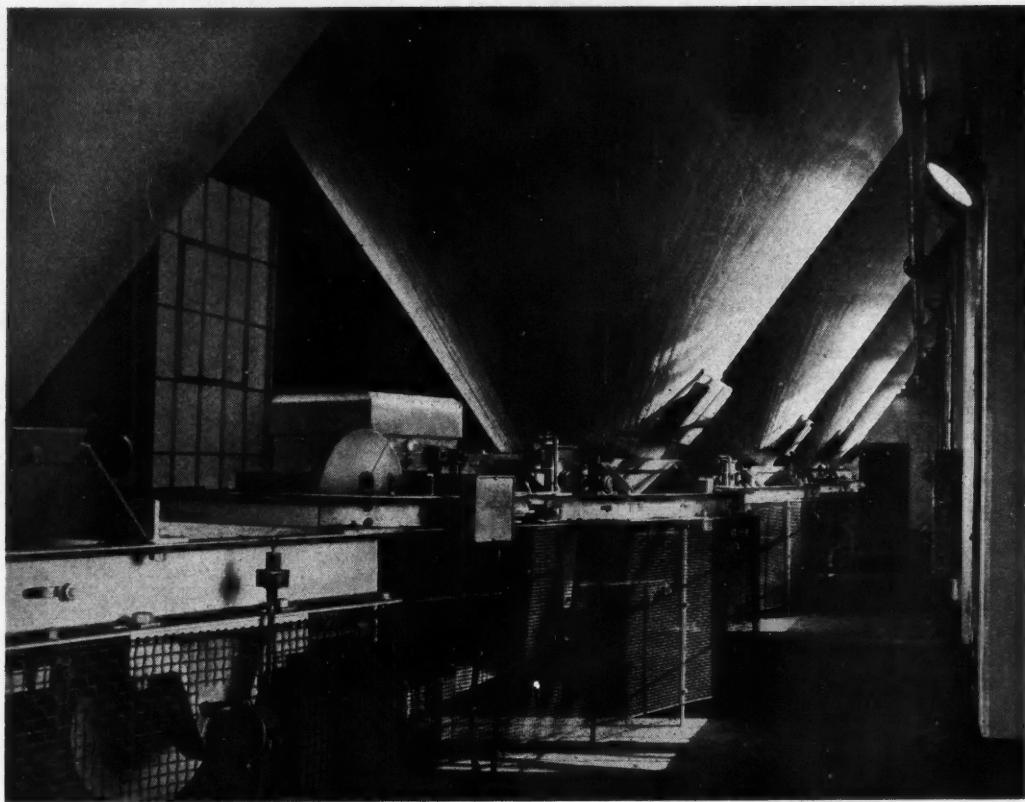
monium phosphate slurry with the added salts and with a re-cycle of dried compound in a blunger. The resultant granules are dried and screened.

**Phosphoric Acid Concentration.** The phosphoric acid is normally of strength 30-32 per cent  $P_2O_5$  and for the purpose of producing NPK ammonium phosphate-based fertilisers by the Dorr process, the strength has to be increased to values in the range 31-37 per cent  $P_2O_5$ . The evaporator used is a single effect vacuum type designed by Svenson Evaporator Co. US.



#### Simplified flow diagram for compounding plant

## CONTINUOUS FEEDING BY WEIGHT



By Courtesy of THE STANTON IRONWORKS CO. LTD.

ILLUSTRATION SHOWS AN INSTALLATION OF FIVE

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deals with gaseous effluent from the neutralisation process.

**Ammonia Distillation.** The ammonia gas is produced by distillation of either synthetic or by-product ammonia liquor containing 20-32 per cent NH<sub>3</sub>. The plants for this duty have been supplied by Copee Ltd. and are designed to work automatically with a minimum of process supervision. There are two synthetic ammonia stills of bubble cap tray design constructed in cast iron heated by 25 p.s.i. steam. The quantity and temperature of feed liquor, the still head and product gas temperature together with gas pressure, are controlled automatically.

The plant for recovery of ammonia from by-product liquor is still being erected. It will comprise a de-acidifier in Hastalloy C, cast iron ammonia still with bubble caps, dephlegmators and gas washers.

**Neutralisation and Granulation.** Wet process phosphoric acid, evaporated to a suitable strength, is neutralised with ammonia gas in reaction vessels to produce a slurry containing ammonium phosphate, ammonium sulphate and impurities such as iron and aluminium phosphates and fluosilicates. Ammonia gas is produced by the distillation of either synthetic or by-product ammonia liquor (in separate distillation units). The nitrogen in ammonium phosphate is only a small proportion of the nitrogen normally required for NPK compound fertilisers and the remainder has to be supplied, either as solid ammonium sulphate or by the neutralisation in the same reaction vessel of added sulphuric acid by gaseous ammonia.

The neutralisation reactions are highly exothermic and during the neutralisation stages in the reaction agitator, a proportion of the water coming in as part of the phosphoric acid is evaporated and vented to the plant scrubbers. This removal of water vapour is important in the overall moisture balance of the plant and affects the evaporative load on the dryer.

#### Four Reaction Vessels

Four reaction vessels are provided in the neutralisation system. In the first, phosphoric acid is either mixed with solid ammonium sulphate or alternatively a measured quantity of sulphuric acid is added. In the second, the phosphoric acid and any added sulphuric acid is neutralised by the addition of gaseous ammonia. If required, the fourth vessel can be used for adding Gafsa phosphate rock for those fertiliser compositions requiring P<sub>2</sub>O<sub>5</sub> in their formulation.

The process results in a slurry of ammonium phosphate and ammonium sulphate containing nitrogen and phosphate. It is necessary to add to this solid sulphate of ammonia and also potash (as muriate of potash containing 60 per cent K<sub>2</sub>O). Since the moisture level in the slurry is too high to granulate properly with only the fresh salts added to the system, it is necessary to carry a recirculating load of dry material. This recirculation is composed of crushed oversize and fines material from the screening

stage and occasionally a proportion of product size material. The slurry meets the newly added salts and the recirculating dry solids in a unit known as a blunger. This is essentially a twin shaft trough mixer which produces from the two streams of material a granular product of moisture content in the region of 5 per cent.

Essentially, the granulation process involves the coating of particles with slurry and the binding together of small particles. From the blunger the material passes to a large rotary co-current drier of diameter 11 ft. and length 93 ft. The drier is fitted with internal lifters preceded by an inlet scroll section and chains to minimise build-up, and the furnace for providing the heat required is of the pulverised coal type. Air-flow from the drier lies in the range 40,000 to 50,000 cu. ft. per minute and is provided by a single stage high efficiency fan supplemented by fans in the scrubbing section of the plant.

From the drier the material passes to a screening section which divides the flow into three parts: oversize, product and fines. The screen sizes for this division are 3mm. and 1.5 mm. respectively. The product is conveyed over a continuous belt weigher direct to bulk transport or to intermediate bulk storage for subsequent bagging and despatch. The oversize is passed via an oversize cracker and returns along with the fines to the blunger station. The new salts are fed to the process through Richard Simon constant weigh feeders controlled by Heenatron elec-

tronic controllers and are ground by Henry Simon Enteleteer mills to the required size specification. Phosphoric acid is metered to process by a Howard feeder and ammonia gas by flowmeter.

Capacity of the granulation plant is 150,000 tons per year.

The gaseous effluent arising from the drier is purified before being discharged to atmosphere, and for this purpose Doyle scrubbers are used which deal with a total of 75,000 cu. ft./minute. The washed gas is almost entirely free from dust and fume and is discharged to atmosphere via a concrete 200 ft. chimney.

**Storage and Packing.** The product from the compounding plant is carried by belt conveyor to hoppers which can be used for filling either road or rail vehicles for bulk transport. Normally bulk material will be transported by Covhop, rail wagons to the site of the storage and packing plants at Salamander Street, the site of the old works.

The bulk storage and packing plants are expected to be complete and in use this summer. Storage is provided for some 40,000 tons product in a reinforced concrete building.

Reclamation of fertilisers will be by bulldozer. The fumes from normal diesel-operated vehicles would be too toxic in the confined spaces and as a result electrically powered bulldozers will be used. Material will be fed to a high-speed packing plant where it will be automatically weighed, valve packed and loaded at rates of up to 180 tons per hour.

## Effluent Drain in Polythene-lined Concrete with Coating of Tiles

**A** NOVEL form of effluent drain has been devised to take waste materials out to sea. Offshore the drain is of cast iron resting on greenheart timber pilings. Most of the inshore drain is piled at 40 ft. centres and rests on concrete beams.

Concrete was moulded round lagged polythene sheet 1/16th in. thick, set in a timber former. When the concrete had set to the polythene the former was removed and the whole length of the plastics coating inspected for defects. It was then lined with a protective layer of Nori tiles, set in latex cement. The drain is a channel that is covered with removable concrete blocks laid as paving stones.

Another service of importance is water which SAI draw from the docks. A pumping station can handle up to 180,000 g.p.h., a quantity that can be increased to 250,000 g.p.h. if necessary.

The 1,470 ft. long conveyor belt system that starts in tunnel alongside the quay is fed by grab cranes into mobile hoppers. Handling capacity is up to 350 tons an hour. Inside the works boundary, the conveyor rises to cross the works and to join a shuttle conveyor 60 ft. up at the top of the 900 ft. long store. The shuttle conveyor can be moved to discharge at a number of points in the store.

The store is sub-divided by movable Stelcon bulkhead sections to accommodate different raw materials. Total cap-

acity of the store is 56,000 tons. The unusual structure consists of precast concrete arches, each 75 ft. long, and is covered in asbestos sheeting. The 6 ft. high concrete retaining walls have a piled foundation. The design is based on a three-pin arch construction and the arches rest on the retaining walls.

The store also receives materials by rail, a weighbridge tippler handling up to 24½ tons net weight at a rate of 350 tons an hour. Material is fed to an open feeder, concrete-cased elevator and belt conveyor to the store's shuttle conveyor.

More than 300 electric motors are installed in the works, those up to 40 h.p. being of the English Electric chemical works type.

As standby to the waste heat boiler on the sulphuric acid plant, three vertical oil-fired Cochran boilers are installed with a capacity of 24,000 lb./hr. at 150 lb. pressure.

A modern workshop provides engineering services for the factory and houses engineering stores. In addition to small laboratories in each main process building, a central control laboratory forms one wing of the main administrative block. Housing the works offices and changing rooms, shower baths, and a canteen, this building, like the process control rooms, has been carried out in a modern style.

# PHYSICAL SOCIETY EXHIBITION

## New Developments to be shown at Royal Horticultural Halls

TRENDS of instrumentation in industry, research and teaching for the next 12 months will be shown at the 42nd Physical Society Exhibition, to be held in the Old and New Halls of the Royal Horticultural Society, on 24 to 27 March. Professor N. F. Mott, president of the Physical Society, will open the exhibition for the press and fellows of the society at 11 a.m. on 24 March.

Hours of opening are: 24 March 10.30 a.m. to 7 p.m. (press and fellows only 10.30 a.m. to 2 p.m.), 25 March 10 a.m. to 9 p.m., 26 March 10 a.m. to 7 p.m., and 27 March 10.30 a.m. to 4.30 p.m.

Three discourses will be given during the exhibition. They are: 'Goethe's colour experiments' by M. H. Wilson (24 March, 5.45 p.m.), 'Some uses of physics in archaeology' by Dr. E. T. Hall (25 March, 5.45 p.m.) and 'Some recent investigations with aircraft on the physics of clouds and rain' by R. J. Murgatroyd (26 March, 5.45 p.m.). Prizegiving for the craftsmanship competition will take place on 27 March at 3 p.m. On 25 March at 3 p.m. and on 27 March at 11.30 a.m., a film on 'The junction transistor in radio receivers', made by the Mullard film unit, will be shown.

### Finned Uranium Cans

Examples of finned sections for the canning of uranium are being exhibited by *Acles and Pollock Ltd.*, Oldbury, Birmingham. The materials used for these sections are aluminium, magnesium aluminium alloy and niobium. In addition, there will be examples of tubing in unusual materials for reactor construction and attendant chemical processes in atomic energy plants. Special metals for the tubing include tantalum, beryllium, vanadium, molybdenum, niobium, zirconium, Zircaloy 2 and titanium. Samples will be shown of seamless, stainless, flexible tubing, flexible joints and annular convoluted tubes and helical-finned steel tubing for heat exchangers. Special thin-walled stainless steel tubing having diameters of up to  $4\frac{1}{2}$  in. with thicknesses down to .005 in. will be illustrated together with bourdon tubes, capillary tubes, pointer tubes, tubular electrodes for cathode ray tubes, multibore tubing and composite tubing. Tubing in non-ferrous metals will also be shown. Stand 56.

### Smoke Alarm System

A smoke alarm system, simple to install, set up, and maintain, has been developed by *Airmec Ltd.*, High Wycombe. It will monitor and record the smoke density from any smoke stack or chimney to provide control of smoke emission in accordance with the requirements laid down in BS.2740.

Smoke density equipment type N250 comprises three units, a photocell, light source, and alarm. These units, when used in conjunction with a recorder type

N235, provide a permanent record of the installation operation, which would be invaluable as evidence if Court issues were involved under the Clean Air Act. Installation of this equipment is straightforward and may be carried out by works engineers. The procedure for alignment and setting up is said to be relatively simple. Stand 3.

### Nucleonic Instruments

Among nucleonic instruments to be shown by *Avo Ltd.*, 92-96 Vauxhall Bridge Road, London SW1, are radiation monitor, No. 1, and a hot spot monitor. The radiation monitor is a light portable, self-calibrating battery-operated instrument. Easy to use, it will measure  $X^-$ ,  $\beta$ - and  $\gamma$  radiations on a 5 in. logarithmic scale calibrated from 1 mr/hr. to 5 r/hr. The hot spot monitor is a light, portable, battery-operated instrument with a remote ion chamber for the measurement of radiation intensity in close proximity to high level sources of  $\beta$ - and  $\gamma$  radiation. Readings can be obtained from 0.1 r/hr. to 500 r/hr.

The Avo d.c. amplifier, which will produce a full-scale reading down to  $3 \times 10^{-10}$  amp., has been designed in conjunction with AERE, Harwell, and the National Physical Laboratory, Teddington, to form a standardised piece of equipment to act as a world-wide reference standard. Stand 29.

### BTL Analyser for Grouped Individual Samples

Among the instruments to be shown by *Baird and Tatlock Ltd.*, 14-17 St. Cross Street, London EC1, will be the BTL Analmatic Analyser for grouped individual samples (batch handling equipment) which includes reagent unit, transfer unit and recording absorptiometer unit. This equipment is used for the automatic analysis of large numbers of samples each of which must be accurately identified, the work being done in racks of 30 test tubes which are moved from unit to unit.

The first part of this equipment was shown at the Society for Analytical Chemistry's congress on modern analytical chemistry at St. Andrews on 22 to

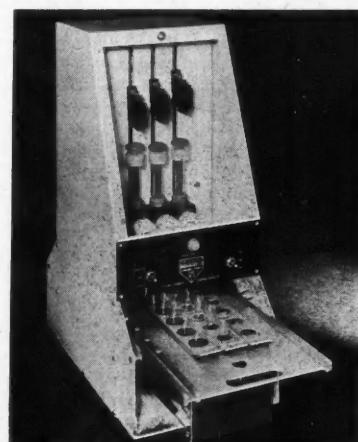
28 June (see CHEMICAL AGE, 6 July, p. 27).

It is designed for those cases where complete automation of the whole process is not required, and where the individual samples are needed for other purposes after the analytical sequence has been completed and the results recorded. In this new development, a separate instrument is used for each main stage of the analysis. The instrument automatically functions when an individual tube, or a rack containing a batch of tubes, is slid into position. The rack is then withdrawn and passed in sequence through the remaining units.

The combination to be shown is in use for the chemical assay of 400 daily samples of penicillin at Glaxo Laboratories, who collaborated in the development. It consists of three units: reagent unit, transfer unit, and recording absorptiometer.

The reagent unit delivers pre-set volumes with high accuracy, employing the barrel and piston principle used in the hypodermic syringe. Pipettes of maximum volumes from 1 to 100 ml. are available, and are easily interchangeable. An adjustable stop above the piston, together with a scale and vernier attachment, enables any desired volume up to the maximum capacity to be delivered. The pipettes fill under the hydrostatic pressure of the reagent and are emptied by the free downward movement of the weighted piston. This complete cycle is initiated each time the rack is moved forward one step. The operation is rapid: with reasonably mobile liquids a rack of 30 tubes, in three rows of 10, is dealt with in about 75 seconds.

The transfer unit automatically takes a predetermined aliquot from one tube and transfers it to a neighbouring tube. As with the reagent unit, single or multiple types are available. A rack containing the tubes for receiving the aliquot is locked to the one containing the



BTL Analmatic automatic dispensing pipette unit

samples and the pair are moved forward step by step into the instrument. Safety devices ensure that the racks can only be moved forward after the pipette carriage has completed the transfer cycle.

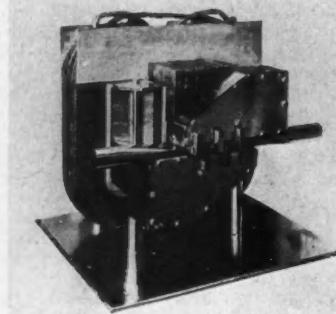
The recording absorptiometer unit is a new design of absorptiometer for the colorimetric measurement of liquid samples in test tubes and can be used alone, or in conjunction with the above units. It is intended for use by semi-skilled operators dealing with large numbers of samples rapidly, a rate of 150 to 300 test tubes per hour being possible.

Baird and Tatlock will also be showing their Analmatic dissolved oxygen recorder, a titration absorptiometer, a fraction collector for chromatography, zone melting techniques and the new BTL electrolytic analysis apparatus developed for laboratories using rotating electrode techniques in metal analysis. Stand 113.

### BT-H Will Exhibit Electromagnetic Pumps

Electromagnetic pumps will be among the exhibits of the British Thomson-Houston Co. Ltd., Rugby.

These pumps enable a conducting liquid to be circulated by electromagnetic forces developed directly within the liquid, thus eliminating moving parts and the need for glands and seals. For laboratory-scale duty, the single-phase a.c. conduction pump with combined transformer



BT-H 20 gall./min. conduction pump with combined transformer

is recommended. It requires no special supplies and, with the use of appropriate tube materials, can handle mercury and bismuth or sodium and the sodium-potassium alloys. Two sizes will be shown, with nominal ratings of 6 gall./min., 15 lb./sq. in. and 20 gall./min., 20 lb./sq. in., respectively.

Also on the stand will be a xenon flash tube with a flash rate of about one a second with a mean power dissipation of about 100 watts.

Other exhibits will include recent developments in semiconductors, photoelectric relays and control mechanisms and a thermocouple suitable for the measurement of temperature up to 3,000°K. Made from tungsten and a tungsten-rhenium alloy, it is used under vacuum or in inert atmospheres under conditions where optical or radiation pyrometers are precluded. Stand 31.

### Nucleonic Thickness Gauge

The Atomat nucleonic thickness gauge with automatic standardisation, a standard beta gauge to which has been added a new type of automatic standardising equipment, designed to maintain the measuring instrument in a constant state of accuracy, will be shown by the Baldwin Instrument Co. Ltd., Brooklands Works, Dartford. The standardising part of the equipment is available for use with existing Atomats.

A number of vacuum cell densitometers are available, each based on a vacuum cell photometer having a high sensitivity coupled with a high degree of stability. Facilities exist in all the densitometers for the utilisation of colour filters to permit the measurement of colour. Included among the exhibits will be reflection, transmission and line densitometers.

The flame photometer to be shown consists of a burner (for acetylene) fed with an air supply in which the sample material has been finely dispersed by an atomiser. Light from the burner, which shows a high degree of stability, is collimated by condenser lenses, and selected filters directed onto a vacuum type photocell. A stable d.c. amplifier amplifies the current, and the resultant signal is displayed on a direct reading indicating meter. The instrument was designed for the quick and accurate determination of calcium in blood sera, and its accuracy is to within  $\pm 1$  per cent of the observed value. Stand 74.

### BSIRA's Exhibits

Several new items are being displayed by the British Scientific Instrument Research Association, 'Sira', South Hill, Chislehurst, Kent. There is a hygrometer for the range 0-1 per cent relative humidity. Porous ceramic transducers measure atmospheric humidity in terms of electrical resistance. Their resistance-humidity relationship can be varied within limits and they can be used, either for measurement or control, in any range of humidity variation. In particular, these transducers remain sensitive in the region below 1 per cent r.h. (corresponding to dew points below  $-35^{\circ}\text{C}$ ). A simple instrument will be shown, calibrated from 0 to 1 per cent r.h. The transducer is a small element of partially reduced titania and its resistance is indicated by the off-balance current in a transformer-fed bridge.

An investigation has been made of the limit of accuracy attainable when the knife edges are replaced by flexure pivots. In particular, the pan support must have zero stiffness and the effect of translation of the centre of rotation of the pivot, as it deflects, must be made negligible. An electrical feedback system for torque control and indication is being developed.

To meet demand from the chemical industry for glass thermometers with graduation markings as permanent as the glass itself, a new process has been developed. A coloured stain is produced in the glass surface which is an integral part of the glass structure; it cannot be removed except by destruction of the glass itself. NPL calibration tests show

that no significant change in accuracy takes place during the process.

Samples of this process applied to thermometers produced from the usual lead thermometer glass, normal soda glass and a new type of thermometer glass developed by the Association, will be exhibited. Stand 111.

### New Microscope Condenser

To be displayed by C. Baker of Holborn Ltd., Purley Way, Croydon, is a new microscope condenser which allows light effected field, dark field and phase contrast illumination to be done with the same condenser and which gives a quick changeover from one type of illumination to the other. This has been achieved without the necessity of using annular illumination with the light field. The Baker condenser has full cone illumination for the light field, thus avoiding the danger of artefacts.

S. Iverson and F. H. Smith (*Quart. J. Microscopic Soc.* 98, 151-154), said the following of the Baker interference microscope with refractometer attachment: 'Determination of the refractive index of liquids by the interference microscope was made possible by the use of a specially constructed holder for the liquid. This ensures a permanent lateral separation between the reference and the objective areas and, as the depth of the object is continuously increasing, a system of fringes is observed. The spacing of the fringes is a function of the refractive index of the liquid. By determining this spacing, a measurement of the refractive index is obtained. An accuracy of at least 0.001 in refractive index is obtainable by a single measurement.' Stand 93.

### New Cambridge Instruments

New instruments on show by Cambridge Instrument Co. Ltd., 13 Grosvenor Place, London SW1, will range from purely scientific apparatus, e.g. for surface tension, to specialised industrial equipment e.g. hydrazine recorder.

The electrochemical dissolved oxygen analyser (gas phase transfer type) which records continuously is specific for oxygen even in minute concentrations. It employs a novel electrochemical method of detection and has been designed to meet the requirements of modern high pressure and high temperature steam systems. Glass components have been reduced to a minimum and the few that remain are easily replaceable. The instrument has a zero of high stability, a high sensitivity and an improved method of calibration. There is also a means of detecting (and assessing) the size of errors due to leaks in the equipment itself.

The residual hydrazine recorder is for use in boiler feed plants where hydrazine is used to remove dissolved oxygen from boiler feed water. It consists of an analyser cell through which the feed water is flowing continuously. An electrolyte is fed into it from a small reservoir, in order to give a small conductivity to the water. The measuring cell contains two electrodes between which a small fixed potential is applied. In the presence of

hydrazine a current will flow through the cell, and is proportional to the hydrazine content of the solution. Externally this current passes through a variable resistor across which the potential difference is measured by means of an electronic recorder.

A new, self-contained, pocket-sized, pH meter of high stability and accuracy will be shown. The scale, 0 to 14 pH units, is sub-divided into 0.1 pH units and the instrument has a high over-all accuracy. The electrode system is fitted into a plastics container so that small quantities of liquid can be tested without need of beaker or stand. The instrument, electrode system, and buffer solutions can be contained in a small carrying bag with a shoulder strap. A dry cell electrical supply is contained within the instrument case. The instrument is simple to use and will withstand rough handling. *Stand 97.*

### Automatic Recording Microdensitometer

Chemists interested in precision measurements on X-ray films, either of distances or intensities will be interested in the Wooster automatic recording microdensitometer, to be exhibited by *Crystal Structures Ltd.*, 339 Cherry Hinton Road, Cambridge. A device is built in to the microdensitometer that gives the integrated intensity of lines on a powder photograph without further accessories. If the integrated intensity of spots is required a scanning device can be added. The results are stated to be very reproducible, and optical densities of 0 to 4 can be measured. Even the faintest line that the eye can barely detect shows up in the record, although the electronics are uncomplicated and require the minimum of servicing. A single lamp and single photocell are used, and consequently no elaborate light screening is called for. The records are made on a Honeywell-Brown strip chart recorder, and the instrument may be left to run for considerable periods without attention.

Also on show will be a Wooster X-ray diffractometer and spectrometer which is described as a robust and adaptable instrument giving a maximum  $2\theta$  value of  $170^\circ$ . It is suitable for studying single crystals or powders. Each instrument is made to individual order, and there is room for any accessory to be added that may be required. By means of punched tape the instrument can be made fully automatic if required. *Stand 54.*

### Measurement of Plate Thickness from One Side

A production version of the 1108 Visigauge will be shown by *Dawe Instruments Ltd.*, 99 Uxbridge Road, London W5. This instrument, a prototype of which was shown last year, measures the thickness of material from one side by determining the fundamental natural frequency of vibration in the thickness direction. The thickness is indicated directly on a 21 in. cathode ray tube and dimensions can be compared to within 0.1 per cent.

Applications include corrosion surveys on oil refinery installations and the de-

tection of internal flaws in materials.

Ultrasonic cleaning equipment type 1150 and 1153 will also be shown by *Dawe*. A newly developed rectangular tank and transducer assembly type 1160/T52 has a capacity of about two gallons. Stainless steel immersible bulkhead transducer units permit the introduction of ultrasonic cleaning into existing baths. Uniform ultrasonic cavitation in about 20 gall. of solution is provided by type 1153 in conjunction with eight type 1161/B36 immersible transducers. *Stand 103.*

### DSIR Exhibits

The various stations and laboratories of the *Department of Scientific and Industrial Research*, Charles House, 5-11 Regent Street, London SW1, are exhibiting new apparatus and instruments. Thus the *National Physical Laboratory*, Teddington, Middlesex, is showing microfocus X-ray diffraction techniques, for a low-angle scattering camera in which a relatively intense X-ray beam is focused by specular reflection from the bent glass plates to form a point focus. The resolution is of the order of  $1000 \text{ \AA}$ .

Also from this laboratory is a thermal comparator, a device for rapid comparison of thermal conductivities, and estimation of film thickness and surface finish. The device shown consists of two similar metal balls mounted in insulating material and carrying differentially connected thermocouples. After the unit is heated to a constant temperature excess, it is allowed to rest with one ball in contact with the test surface. The differential e.m.f. observed after 10 seconds is a function of the thermal conductivity of the test material.

The condition of the surface affects the readings, so the surface finish of calibrating and test materials should be comparable. Alternatively, the device can measure surface finish. Other possible uses are estimation of film thickness and non-destructive sorting of materials.

Recent tests at the NPL have shown that an accuracy of 1 in 1000 is attainable with simple aneroid bomb calorimeter which avoids the use of water (except as a pump coolant.) The heat generated by combustion is all absorbed in a heavy copper bomb. Heat losses are almost eliminated by suspending the bomb in a high-vacuum jacket, and the usual isothermal water bath is thereby made unnecessary. A thermistor and high resistance bridge (or a resistance thermometer and a potentiometer) are used for temperature measurements, of which only two, separated by an interval of five minutes, are sufficient for the determination of a heat of combustion.

The *Chemical Research Laboratory*, Teddington, Middlesex, is exhibiting a double-beam infra-red grating spectrometer. In the alternate-path section (aperture f/3.5) two beams of radiation are taken from the same area of the Nernst filament. Samples are placed at a focus of the sources in 'wells.' A potassium bromide foreprism normally isolates the first grating order, and can be set manually for higher orders. Two National Physical Laboratory replica grat-

ings are used to cover the range 1.7-16 $\mu$  in the first order. They are interchanged at  $5\mu$  and are used at aperture f/4.5. Spherical optics are used throughout, and all mechanical components, including slit mechanisms, are of non-critical construction. A ratio-recording electronic system is used with servo-controlled slits. *Stand 20.*

### Non-Destructive Testing by Sonic Methods

Three instruments for the non-destructive testing of materials will be shown by *A. E. Cawell*, 6-8 Victory Arcade, The Broadway, Southall, Middx. In type LDA(M) the specimen is excited into vibration at a resonant mode, the vibrations are cut off and the number of vibrations occurring in a pre-determined time interval are counted.



LDA ultrasonic tester by Cawell being used for quality control of steel bars.

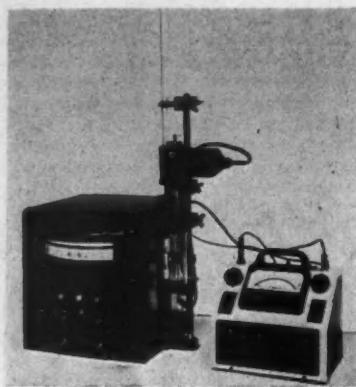
From this measurement it is possible to measure, observe or control changes due to hardening, temperature, stress, non-homogeneity, order-disorder effects, crystallisations, flaws, porosity, chemical composition and so on.

Equipment type UCT measures accurately the time taken for 100 kc/sec. pulsed vibrations to traverse a specimen which may vary from three in. to 10 ft. in thickness. The equipment is used in the concrete industry, where there is an empirical relationship between compressive strength and velocity, and for testing ceramics, plastics, bricks, tiles, glass, timber and coal.

Property changes can be followed using the equipment-type SCT in which a vibration working between 100 and 10,000 c/s is adjusted to the fundamental longitudinal resonance of the specimen. The method is mainly of use in the laboratory. *Stand 105.*

### Automatic Titrimeter by Doran Instruments

An automatic titrimeter (Cat. No. M.4910) has been designed by *Doran Instrument Co. Ltd.*, Stroud, Gloucester, for use with their standard pH indicator (Cat. No. M.4940) which has ranges of 0-10 pH, 4-14 pH and  $\pm 0$ -1000 mV together with a high input impedance suit-



Doran automatic titrimeter and pH indicator

able for use with the normal calomel electrode system.

The pH indicator circuit employs a matched pair of valves in a bridge network which, with careful stabilisation of the h.t. voltage, renders the reading of the test solution value independent of moderate changes of mains input voltage. The application of the e.m.f. from the test cell causes a deflection of the controller indicator proportional to the pH or mV value of the test cell.

Operation of the two relays associated with the two control indexes is used to regulate the addition of reagent to the test solution. Provision is made for the remote manual operation of the burette by 'fast' and 'slow' push buttons which enables complete titration curves to be plotted.

A single solenoid operated valve is used for reagent addition, the flow through the valve being either 'fast' or 'slow' according to the setting of the controller. The slow flow may be adjusted by means of a screwdriver slot control between a maximum of approximately 5 ml./sec. and a minimum of 0.02 ml./sec. The accuracy of measurement is 0.1 pH or 10 mV according to the range in use, but greater accuracy is possible by 'buffering' the electrodes with a buffer solution of a value near that of the required end point.

The solenoid operated valve, burette and stirrer motor are mounted on the side of the instrument case together with the electrode system, the test solution being contained in a 250 ml. beaker. The circuit may also be adapted for control or alarm purposes between two pH values, in which case the burette, solenoid-operated valve, and the associated circuits are not required. On or off switching at either control index, capacity 5A (non-inductive) or 3A (inductive), at 250 volts is available. Stand 68.

#### Dynatron Pulse Analyser and Scaling Unit

Several new and improved instruments which will be available commercially very shortly from the nucleonic and electronic department of Dynatron Radio Ltd., The Firs, Castle Hill, Maidenhead, Berks, will be on display.

Described as an ideal instrument for use in gamma spectrometry is the single channel scanning pulse analyser, type

N.102. It comprises a fast threshold amplifier followed by two discriminators, and gives an output pulse when the lower discriminator only is triggered. Threshold (lower discriminator) level is set by means of a potentiometer which may be operated manually or driven by a synchronous motor. The threshold can thus be 'scanned' while the channel width remains fixed at a value which can be set between 0-50V.

Output of the analyser may be fed to either a scaler or a ratemeter. If the latter is used a continuous spectrum record can be obtained by feeding the ratemeter output to a suitable chart recorder.

Power Unit type N.103 will supply the high voltage needed by most types of counters used in nuclear physics, especially scintillation counters and other proportional counters where extreme stability is required. Stability is ensured by a specially designed feedback amplifier, and ripple and spurious pulses are reduced to such a level that external filters are not normally required. A high impedance output is provided for use with gas proportional counters where absence of pulses and ripple is of paramount importance.

Scaling Unit type 1009E with associated cooling unit incorporates all the advantages of the 1009D scaler but has a resettable mechanical register which provides an increased counting speed of 2,500 per sec. The scaler is designed to count random or regular electrical pulses of amplitude greater than a pre-determined value which may be set between + 5 and + 50V. Stand 34.

#### Leak Detector for Vacuum Apparatus

On the stand of *Edwards High Vacuum Ltd.*, Manor Royal, Crawley, Sussex, will be a new high sensitivity leak detector, Model GD1, applicable to outward leakage and vacuum apparatus. Samples of air from suspected areas are continuously induced over an electrically heated element, the temperature and hence resistance of which changes when leakage gas is induced. A leak as small as 1/50 ounce of hydrogen per year can be readily located.

Also new are model CG3 metal case capsule dial gauges which are barometrically compensated 'aneroid' type manometers in the ranges 0-20, 0-40, 0-100 and 0-760 mm.Hg. with casings (additional to the plastics versions hitherto available) for systems requiring initial exhaustion to low pressures, and the model B4 miniature Pirani type vacuum gauge, operated from batteries or mains for the range 1-500 microns Hg.

The company are introducing a new vacuum fusion gas extraction and analysis equipment. This is a completely self-contained unit for the vacuum extraction and analysis of gases in metal samples. The furnace head for the fusion of the samples is of stainless steel construction and carries a water-cooled vertical silica furnace tube. Power required for specimen melting is of the order of 6 kW. RF and the maximum crucible temperature is of the order of

2400°C. Evacuation of the furnace is carried out by a combination of Speedivac rotary and diffusion pumps, selected to give the greatest overall efficiency in out-gassing the vacuum system, and in reaching the lowest possible pressure for complete gas extraction from specimens. A glass Toepler pump either expels the gases into a vessel for separate analysis or into an analysis section fitted to the equipment. Stand 107.

#### New Type Scintillation Counter

Examples of the latest techniques in the use of radioactive isotopes in industry and medicine will be seen on the stand of *Ekco Electronics Ltd.*, Southend-on-Sea, Essex.

The new type N612 beta scintillation counter will be demonstrated with a type N530 scaler. Developed for counting low energy beta particles, the type N612 is stated to be especially useful for the assay of carbon -14 and tritium. An interlocked shutter prevents light falling on the photomultiplier tube when sources are changed and the source/phosphor container is optically coupled to the photomultiplier cathode by a suitable liquid. Using carbon -14 at room temperatures, overall counting efficiencies of 50 per cent or more are said to be obtainable.

A new ultra-light weight scintillation counter, Type N618, will be demonstrated in conjunction with an Ekco ratemeter. For use with ratemeters and scalers without an amplifier, a separate wide-band amplifier with a range of switched gains is available. Of small physical size, the Type N618 is watertight.

Also to be introduced is a new Ekco ratemeter of improved accuracy and stability. Employing a single channel pulse height analyser, which incorporates both constant voltage and constant percentage channel widths, as well as a wide band amplifier, this instrument, Type N600, can be used as a simple gamma spectrometer analyser in conjunction with a standard scintillation counter and suitable recorder. Of unit construction, the Type N600 has an overall resolving time of about 3 micro-seconds. Stand 24.

#### Three Additions to Deoxo Range

There have been three recent additions to the Baker range of Deoxo catalytic gas purifiers produced by *Engelhard Industries Ltd.*, Baker Platinum Division, 52 High Holborn, London WC1. Of these, two—the DH and the K—are specifically designed to selectively hydrogenate acetylene occurring as an impurity in ethylene or ethylene-containing streams. The DH unit operates at 110°C while the K operates at 200°C. The latter purifier has a longer active life although both units can be regenerated *in situ*. These units are capable of handling high throughputs and of reducing the acetylene impurity to less than 10 v.p.m.

The third type of purifier being exhibited is designed to remove traces of acetylene from air by oxidation to carbon dioxide. This application is of considerable importance in air liquefaction where

acetylene can accumulate in the system and become a serious explosion hazard. The purifier operates at temperatures below 150°C and at a high space velocity.

The exhibition model, a Baker-Hersch dissolved oxygen meter, utilises the same galvanic principle for the measurement of oxygen as the commercially proved Hersch oxygen meter. It is designed to operate in two ranges, the most sensitive of which covers the boiler feed water application of 0-0.025 p.p.m. The instrument operates on a water flow of 15 l.p.h. and has a speed of response of the order of two minutes. Calibration can be carried out on the spot by a built-in unit and accurate zeroing on an oxygen-free gas is provided for by means of a cold catalyst. The instrument will accept water at pressures up to 130 p.s.i.g. and temperatures up to 125°C. Stand 78.

### BS-Designed Ovens

A new range of ovens (to British Standard 2648) and incubators will be featured by *A. Gallenkamp and Co. Ltd.*, Sun Street, London EC2. The temperature range of the ovens is up to 200°C which is reached within 65 minutes from room temperature. At 100°C the temperature variation between any two points in the working space does not exceed  $\pm 2.5^\circ\text{C}$ , while the fluctuation at any single point is not more than  $0.25^\circ\text{C}$ . The incubators are designed to have a maximum working temperature of 100°C.

In order to satisfy exacting standards it was necessary to design and manufacture a special hydraulic thermostat known as the Compenstat (provisional patent No. 18565/57).

Advantages claimed for the Compenstat over other types of temperature controllers are: Snap-action contacts can be used; these contacts cause negligible television and radio interference; temperature setting is not affected by wear of contacts, which in any case is negligible on the Compenstat or by changes in barometric pressure, or in external temperature (control-head temperature); no relay is required in the control circuit, thus eliminating a possible source of breakdown.

Both the ovens and incubators are made in three sizes, and the ovens may be obtained with or without mechanical convection. The liner, door box, shelves and supports are made in a superior quality, smooth-finish, stainless steel.

Designed in co-operation with Mr. C.

Heitler of Northampton College of Advanced Technology (London), for rapid and accurate determinations of molecular weights of organic solids and liquids, the semimicro-ebulliometer accurately measures the elevation of the boiling point of a solvent on the addition of a solute. Previous limitations of ebulliometric methods are said to be overcome by the novel design of the boiling chamber and the use of a thermistor sensing element of low thermal capacity. Known weights of the compound under examination, in either tablet or liquid form, are added to the solvent contained in the ebulliometer chamber, and the changes of resistance of the thermistor measured. The system reaches equilibrium in less than three minutes; accuracy to  $\pm 2$  per cent with 50 mg., to  $\pm 0.8$  per cent with 200 mg. compound is claimed.

A general purpose water bath of advanced design, features control by the new Gallenkamp Compenstat. It is of stainless steel construction and has a large unobstructed working space. The motor-driven shaking rack is available as an accessory for experimental and routine investigations requiring agitation in conditions of controlled temperature and, where necessary, controlled atmosphere. Stand 69.

### Four Computers by Elliott Brothers

One of the main features on the stand of *Elliott Brothers (London) Ltd.*, Lewisham, Rochester, Boreham Wood and Weymouth, will be the exhibition of four computers, ranging from a comparatively large 402F floating-point digital machine to a miniaturised analogue equipment for use in airborne flight-control systems. Three of the four computers shown will be working.

The floating-point unit of the 402F deals with numbers in the range  $2^{-30}$  to  $2^{+31}$  with sign, numbers outside this range being treated as zero and infinity respectively. This mode of operation has two advantages: it enables problems in which the data would go out-of-scale on a fixed-point machine to be solved, and it simplifies programming in that it eliminates the need for scaling data into the range 0 to 1.

Versatility of the 402F will be demonstrated by accepting various classes of problems for solution at high speed while visitors wait at the stand.

Elliott's nuclear division will demonstrate an Elliott reactor simulator type ND 181. This equipment, which is primarily for the instruction of nuclear engineers, has been designed to represent the operation of a nuclear reactor under a wide range of conditions.

The unit is constructed in the form of a reactor control desk on which indications of power level, control and safety rod positions, etc., are displayed. The unit may be operated manually or use may be made of two automatic control systems, one an on-off system and the other a proportional system. Trips are incorporated to shut down the reactor should either the power level or period pass through adjustable limits.

Based on a newly developed full-wave bridge network system are industrial frequency indicators which employ standard moving-coil meters, available in a variety of sizes and types, including round (2 in., 2½ in., 3½ in., 4 in., 6 in. and 8 in. diameter), square (2 in. to 33 in.), rectangular, and sector patterns. Where a permanent record of frequency variation is required, miniature recorders with 3 in. wide charts can be supplied. Stand 106.

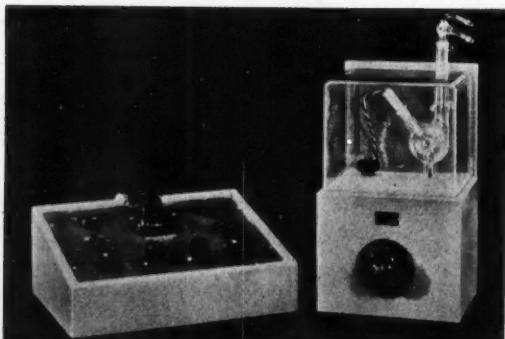
### Automatic Polarimeters and Counting Equipment

Among the exhibits to be featured by the Instrument Division, *Ericsson Telephones Ltd.*, High Church Street, New Basford, Nottingham, will be the ETL-NPL automatic polarimeter type 143A.

It is still in the prototype stage and has been developed from an original design produced by the National Physical Laboratory. Although primarily intended for the continuous monitoring of the concentration of sugar solutions, its application is by no means confined to the sugar industry. The polarimeter provides continuous monitoring of optical rotations up to  $\pm 0.5^\circ$  of arc with a precision of the order of  $0.0002^\circ$  of arc. It is stated to have a sensitivity approximately ten times greater than that of visually balanced instruments, consequently relatively short path lengths can be used. The optical rotation of a sample is automatically balanced out by a null method using direct current fed back to a Faraday cell. This current is proportional to the optical rotation to be measured, and can be indicated either on a recording instrument or digital display.

Counting equipment type 127A has been designed to cater for most nucleonic counting requirements, where a fast and reliable count rate is required. The complete counting equipment comprises a pre-amplifier, quench unit, EHT unit, amplifier discriminator, high speed scaling unit, logarithmic and linear ratemeters, and a timing unit. With the exception of the first two items, these instruments can be rack mounted in an attractive hammer-green finished mild steel cabinet. All have dark green front panels and dust covers.

The pre-amplifier is designed for amplification of scintillation counter pulses. It has a gain of 5, or 50 as required, and



Gallenkamp  
ebulliometer.

the maximum sensitivity referred to the input terminal is 200  $\mu$ V with the full gain of the amplifier discriminator.

The quench unit works in conjunction with a G-M tube, and the scaling unit type 127A. Six known quench times are provided, ranging from 100 micro-seconds to 600 micro-seconds, in 100 micro-second steps. *Stand 13.*

### Portable $\text{SO}_2$ Meter and Spherical Haze Meter

A portable meter, the Eel  $\text{SO}_2$  meter, to enable rapid measurements of the sulphur dioxide in the atmosphere, developed by the Central Electricity Research Laboratories, will be displayed by *Evans Electrodeselenium Ltd.*, North Street, Bishop's Stortford, Herts. Air drawn from the atmosphere comes in contact with a starch-iodine reagent which is partially discoloured by the  $\text{SO}_2$  present. The absorption of light by the unchanged reagent is compared with that of the partially discoloured reagent by means of barrier-layer photo-cells connected to a galvanometer.

Also on show will be the Eel spherical haze meter, an instrument developed for the ASTM standard method of testing for haze and luminous transmission of transparent plastics. It consists of a stabilised light source and condenser lens giving a parallel beam of light which passes through the specimen to a pivoted sphere having a photo-cell positioned at 90° to the path of light. The current generated is measured by an external Eel galvanometer. *Stand 46.*

### Ceramic to Metal Seals

Ceramic to metal seals have been developed by *Ferranti Ltd.*, Hollinwood, Lancs, to overcome the limits imposed upon valve performance by the use of conventional glass to metal seals. Several types are available for various applications. New developments covering the following will be exhibited: Compression type seals of diameters exceeding 3 in. between alumina ceramic and nickel-iron alloy; butt seals between metal and ceramic of matched expansion coefficients; and metallurgical sections of typical ceramic to metal seals. *Stand 25.*

### Thermal Analysis Apparatus

On the research laboratories stand of the *General Electric Co. Ltd.*, Magnet House, Kingsway, London WC2, apparatus will be shown for the investigation of the dynamic properties of a.c. discharges, and for differential thermal analysis of chemical reactions in glass and refractory production; also semiconductor devices and applications, specimens of high-expansion glasses, a radiation pyrometer, and highly-loaded low-pressure fluorescent tubes.

For differential thermal analysis of chemical reactions in glass and refractory production, an experimental apparatus is exhibited consisting of a special crucible assembly used for investigating the reactions which occur between the different

raw materials during glass manufacture. The same apparatus is reported to be applicable to studies connected with the development of new corrosion-resistant refractory materials for lining glass melting furnaces.

New high expansion glasses for sealing to copper, nickel and stainless steel will be shown. This range of durable glasses, which is now in production, has high linear coefficients of thermal expansion in the range 15 to  $18 \times 10^{-6}$  per degree and has been developed for use as electrical insulators. *Stand 22.*

### New Analytical Apparatus

Two recently developed pieces of equipment embodying modern scientific techniques will be displayed by *Griffin and George Ltd.*, Ealing Road, Alperton, Middlesex.

The Griffin VPC apparatus Mk II for the analysis at reduced pressures of mixtures having components with boiling points up to 350°C at atmospheric pressure, is fitted with two ovens each with an independently-controlled thermostat and motor-driven fan for mechanical air convection. Analysis of mixtures by gas-liquid partition chromatography is thus greatly accelerated since while one resolution is proceeding in the first oven, the second can be prepared with its packed columns and maintained at its required temperature until the carrier gas can be switched to the columns by means of the included double-valve system.

Routine continuous calorific value determinations on coal, coke, oils, etc., to the highest accuracy can be achieved with the new Griffin-BCRA isothermal bomb calorimeter also exhibited.

The calorimeter vessel incorporates design features recommended by H. C. Dickson of the US National Bureau of Standards. The design of the isothermally-controlled jacket is based on extensive tests by the British Coke Research Association on the design of calorimetric systems.

Standard deviations of 0.1 per cent of the mean value can be achieved as a matter of routine, it is claimed, but under carefully controlled conditions higher accuracies resulting in standard deviations of less than 0.1 per cent can be obtained. *Stand 57.*

### Infra-red Spectrophotometer Attachments

*Hilger and Watts Ltd.*, 98 St. Pancras Way, London NW1, have developed a new double-beam polariser for the Hilger H 800 infra-red spectrophotometer which uses selenium films in transmission. They act as plane polarisers when the incident beam is inclined at the Brewster angle. The films are oval, about 10 cm. by 5 cm., and about 4 microns thick. They are mounted in a cylindrical tube. Efficiency is stated to vary slightly with wavelength, but is always better than 96 per cent.

Also on show will be the new integrator for the H 800 spectrophotometer which measures the charted area of an infra-red

absorption band. This area is sensibly independent of slit-width and depends mainly on the absorption properties of the sample. The integrator is said to make it easier and quicker to calculate absorption coefficients.

Exhibits include a simple instrument, made by James Swift and Son Ltd., which can be adapted for almost any microscope with a close-line eyepiece graticule. The instrument has two parts: one is an electrically operated mechanical stage, which scans the specimen in discrete predetermined steps, and the other a set of counters, each of which is for recording the occurrence under the cross-lines of a particular constituent. When the microscopist has identified a constituent he presses the appropriate key and the relevant counter registers the next higher number while the mechanical stage moves on a step. The instrument is therefore a micro-sampler, counting the number of occurrences of particular constituents at points in a regular grid. It is mains operated and can be equipped with counters for either seven or 14 constituents.

A Hilger Tristimulus colorimeter will be displayed on the stand of the colour group of the Physical Society. It will be arranged for surface measurement of colour. *Stand 92.*

### IR Gas Analyser for Water Vapour

For the absolute measurement of water vapour in a great variety of gas mixtures, a special instrument has been developed by the *Infra Red Development Co. Ltd.*, Welwyn Garden City, Herts. The instrument measures the partial pressure of water in a mixture at atmospheric pressure and ambient temperature. It is also calibrated in dewpoint temperature, and the standard range is from 0-1.5 mm. Hg pressure, corresponding to a dewpoint range of -13°C down to below -50°C.

A sample can be continuously drawn through the instrument at any flow rate between zero and 3 litres per minute, and the indication lag is about 5 seconds. It is stated that there is no hysteresis effect; the indication is in absolute units and does not depend on the temperature of the sampling point (gas mixture should be brought near ambient temperature in the sampling time).

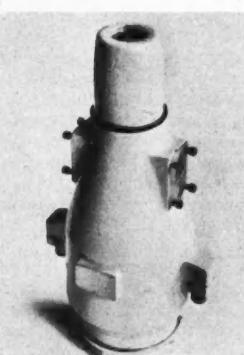
The instrument may be used differentially, to measure changes in humidity, with reference to saturation, or some other fixed condition. Size of the instrument is 14 in. wide by 8 in. deep by 28 in. high. With the transformer it weighs 94 lb. Price of the absolute humidity meter, type L/S/C/R scaled 0-1.5 mm. Hg.  $\text{H}_2\text{O}$ , or any range up to 0-6 mm. Hg. is £425, complete with specially prepared 2 cu. ft. cylinder of  $\text{H}_2\text{O}$  mixture for checking the scale length, and a separate stabilising mains transformer for 200-250 volts 50 cycles a.c. supply.

In addition, a micromanometer will be exhibited. This is described as a sensitive pressure measuring device having a full scale deflection of  $\pm 0.005$  in. water gauge. The sensitivity element consists of two cavities having a metal diaphragm

between them, the pressure difference being measured as a change in capacitance between the diaphragm and adjacent fixed plates. The element is stated to have a rapid response, and sine wave pressure variations up to 200 c/s can be measured. The instrument can be used to measure flue pressures, flows in pipes with a minimum pressure loss, etc. Stand 62.

### Liquid Level Control

Among equipment to be exhibited by *Isotope Developments Ltd.*, Beenham Grange, Aldermaston Wharf, nr. Reading, Berks, will be a gamma switch, type 656. This device can be used as a gamma or X-ray radiation alarm, or can be employed for industrial applications such as level control. It consists essentially of a Geiger-Müller tube in circuit with a switch.



IDL type 700 scintillation counter head

Industrially, it is used in conjunction with the source of gamma rays. For on/off level control the source and gamma switch are placed on opposite sides of the vessel. When the contents level in the vessel passes between them the switch operates, thus providing facility for operating warning lights or automatic level control mechanisms.

The 700 Scintillation Counter Head is shielded in all directions, except for an opening to which interchangeable collimators can be fitted. These allow, for example, accurate location of radioactive deposits in the human body or general measurement of uptake and body background.

The head is available either with a built-in amplifier to suit existing scalers and ratemeters, or with a direct output. Stand 15.

### Platinum Resistance Thermometers

Platinum resistance thermometers which provide a precise means of measuring temperatures in the range from -200°C to +650°C will be exhibited by *Johnson, Matthey and Co. Ltd.*, 73-83 Hatton Garden, London EC1. With care these thermometers can be operated up to 1000°C.

A new introduction will be noble metal thermocouples: 10 per cent rhodium-platinum, platinum: 13 per cent rhodium-platinum, and 5 per cent rhodium-platinum: 20 per cent rhodium-platinum thermocouples. The first two can be

used continuously for temperatures up to 1400°C, and the 5 per cent, 20 per cent couple continuously up to 1700°C and intermittently up to 1820°C. Also on show will be the Pallador thermocouple (40 per cent palladium gold: 10 per cent iridium-platinum) which has a maximum operating temperature of 800°C.

This company will also exhibit a variety of precision drawn resistance wires, one type being composed of a new alloy having a specific resistance some 50 per cent higher than 80/20 nickel chromium. Stand 80.

### Hermetically Sealed Switch

For switching in explosive atmospheres or in cases where exposure to severe climatic conditions is necessary, *Kelvin and Hughes Ltd.*, New North Road, Barkingside, Essex, have a new switch which is hermetically sealed and filled with inert gas. It will operate through the wall of the container by the flux linkage between two permanent magnets, one of which is inside and the other outside the casing. The switch is operated by angular movement of a shaft, and a torque of 25 gm-cm. through 20° is required. Similar switches are available operated by continuous rotation or by linear movement. The inert gas filling enables heavy currents to be switched relative to the size of the switch. Stand 75.

### Potted Selenium Cells

Improved 'potted' selenium cells, stated to be tropical fast and resistant to chemical attack, will be displayed by *Megatron Ltd.*, 115a Fonthill Road, London N4. On show for the first time will be an integrating light meter developed in co-operation with the National Institute of Agricultural Engineering. Stand 77.

### Sulphur Dioxide Recorder

A production version of the prototype Mervyn Harwell Square Wave Polarograph Mark III, shown last year, is being exhibited by *Mervyn Instruments Ltd.*, Copse Road, St. John's, Woking, Surrey. All controls come easily to hand and adequate working space is available on the acid-resistant desk top. A thermostatically controlled cell holder is built in and contains four modified Barker type cells, with twin dropping electrodes. A supply of oxygen-free nitrogen is also incorporated.

A new instrument on show will be the Mervyn CEA Sulphur Dioxide Recorder which has been specially designed for the analysis of sulphur dioxide in the atmosphere in concentrations down to 0.01 p.p.m. The instrument operates continuously, and the result is presented on a recorder chart. The method used is to absorb the sulphur dioxide in a reagent containing hydrogen peroxide. This oxidises the sulphur dioxide to sulphuric acid, and the resulting increase in the conductivity of the solution is measured. The special counter-current absorption column ensures that the sulphur dioxide is completely dissolved. Conductivity is measured in special cells, designed in such a way that the volume of liquid present at any instant is small and is swept away by the incoming liquid without mixing.

Resistance of the cell is measured in a conventional bridge circuit, to give an output of 0 to 0.5 mA d.c. for a range of liquid resistance of about 200 to 1000 ohms. The circuit is compensated for changes in mains voltage. A low voltage alternating current is applied to the electrodes. The complete instrument is temperature compensated and is designed for arduous use for long periods without attention. Stand 76.

### Nuclear Magnetic Resonance Spectrometer

An experimental prototype of an apparatus intended for the observation of nuclear magnetic resonance in liquids under conditions of high resolution will be featured by *Metropolitan-Vickers Electrical Co. Ltd.*, Trafford Park, Manchester 17. The basic part of the apparatus consists of an electro-magnet with its associated power supply which provides a magnetic field continuously variable up to at least 15,000 gauss.

The sample to be examined is inserted in a probe unit which can be moved to any position within 3 in. of the centre of the magnet by an externally controlled mechanism which also records the probe position. The probe consists essentially of a cross-coil system, the resonance signals being observed according to the Bloch technique.

Electronic units provide for sweeping the magnetic field through resonance, detection and amplification of the resonance signal and display on either a long persistence cathode-ray oscilloscope screen or a pen recorder. Stand 72.

### Ministry of Supply Exhibits

Seven of the *Ministry of Supply's Establishments* will demonstrate a total of seventeen techniques and devices developed during the past year. Those exhibits of interest to chemists are recorded below. The Explosives Research and Development Establishment has developed vapour phase chromatography equipment which is intended primarily for purification of small quantities of material for research application and for the analysis of unknown mixtures. It enables samples of up to 0.5 gm. to be separated into individual components in sufficient quantity to enable them to be identified with an infra-red spectrometer.

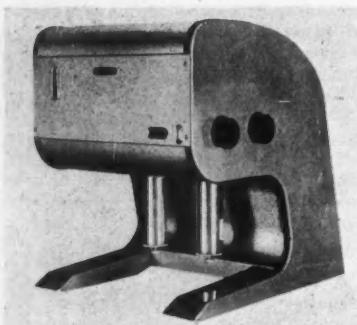
From the Chemical Inspectorate has come two new pieces of apparatus. A thermogravimetry balance records the change of weight of material treated in an electric furnace over suitable ranges of temperature. The off-balance of the beam is detected by a linear variable differential transformer, and the balance restored by the change in weight of the suspended electrode of a silver coulometer.

A six-column gas chromatograph has been designed for laboratory use to analyse a wide variety of materials as rapidly as possible. Built on the unit system with two columns to each section, the units can be formed together as required and connected to a single gas supply and vacuum system. Each column is housed in a separate thermostatted oven, has its own detector and gas flow controls and provision for collection of fractions.

A demonstration of a water stabilised plasma jet arc will be given by the Royal Aircraft Establishment. It will show the generation of a plasma jet for the study of high temperature gas streams of high velocity and for the study of the behaviour of materials exposed to high temperature conditions such as exist behind intense shock waves. The nozzle of the apparatus used in the demonstration is  $\frac{1}{4}$  in. diameter and the power input is about 25 kW. Stand 1.

### Quartz Fibre Balance

New to the range of balances made by *L. Oertling Ltd.*, Cray Valley Works, St. Mary Cray, Orpington, Kent, is the quartz fibre ultra micro balance. This is a prototype balance which is designed to weigh with an accuracy of 0.1 microgramme, and is capable of handling loads of up to about 0.5 g. This instrument is stated to be ten times more sensitive than the conventional micro balance. The beam is made from fine quartz fibres and is suspended by a torsion fibre system specially designed to ensure high stability.



Fibre ultra micro balance

The one pan balances, first introduced in 1957, incorporate full mechanical manipulation of all weights on all models. The beam is of delta form made from light alloy, and together with all the mechanism is totally enclosed. This ensures operation under even temperature conditions and protects the mechanism from draughts, fumes and dirt.

Release of the balances is operated by a press bar and the knives and planes are fully protected from damage by the Releas-o-matic mechanism. The controls are grouped in order to give rapid and fatigue-free weighing.

The pans are designed for ease of access and the appearance of the instrument is suitable for both old and new laboratories.

The aim of the design has been to give the user reliable and rapid weighing with a minimum of service and attention. These balances represent the best modern high precision weighing practice.

The range of one-pan balances introduced last year is as follows:

Model	12HO1	12HO2	12HO3
Capacity (g)	200	200	100
Sensitivity per half division (mg)	0.1	0.5	0.05

Mean standard deviation (mg) 0.05 0.2 0.03

To the range of two pan balances, also introduced in 1957, has now been added

a semi-micro balance with a sensitivity of 0.1 mg per scale division (Model 12F07), and with automatic weight manipulation up to 1g. Stand 88.

### New Thermocouple and HF Titrimeter

A silicon carbide/graphite thermocouple will be displayed by the *Morgan Crucible Co. Ltd.*, Battersea Church Road, London SW11. It consists of an inner graphite rod cemented into an outer silicon carbide tube of approximately  $\frac{1}{4}$  in. diameter by 12 in. long. The company consider that it should be possible to use the thermocouple to temperatures of about 1900°C without a protective sheath. In addition, voltages of the order of 250 to 500 millivolts are obtained in the range 1000 to 1900°C.

For detection of end points in solutions where visual indicators cannot be used or give unsatisfactory end-points (e.g. the titration of coloured solutions or the titration of fluoride with thorium nitrate) Morgan Crucible research laboratories have developed the HF Titrimeter. It is basically a 2 Mc/s crystal-controlled oscillator which gives a stable excitation signal to the solution in the glass titration cell via the copper band electrodes which do not come into contact with the solution. Stand 36.

### Proton Spectrography by Magnetic Resonance

Demonstrations will be given by *Mullard Ltd.*, Mullard House, Torrington Place, London WC1, of equipment which is a completely self-contained system for high resolution proton spectrography by magnetic resonance.

The spectrometer consists of (1) a large, controlled temperature Ticonal permanent magnet, in the field of which a spinning specimen is located by a micro-manipulator; (2) electronic apparatus for sweeping the field through the required range; and (3) means of observing and recording graphically the nuclear magnetic resonance spectrum. Nominal field strength of the magnet is 7500 gauss.

Important features of the spectrometer are described as the high degree of uniformity of the magnet field and high overall stability. A typical field uniformity is of the order of 1 part in  $10^7$  to  $10^8$ , and the spectrometer is capable of recording the fine structure of the ethyl alcohol spectrum.

Operation of the equipment is based on the Purcell absorption technique, using a single coil. This allows the probe used for introducing the specimen into the field to be of very simple design, and therefore affords great flexibility in varying the temperature of the specimen.

Another new development to be shown, a metal tap for use in ultra-high vacuum systems, was originally produced for research projects involving ultra-high vacuums. The tap has been designed for operation at pressures as low as  $10^{-9}$  mm. Hg. with the usual vacuum greases, thereby avoiding vaporisation into the

system. It is also designed to withstand baking-out. A 150W element is incorporated in the base of the tap which is capable of raising its temperature to 200°C, providing an alternative to the general bake-out of the vacuum system.

The tap can be supplied with all-copper inlet and outlet tubes for incorporation in the metal systems, or with special alloy ends to the tubes for sealing into glass systems. Stand 104.

### Automatic Liquid Dispenser

Among exhibits by *Nash and Thompson Ltd.*, Oakcroft Road, Chessington, Surrey, will be an automatic liquid dispenser which was originally designed for multiple serological titrations. It has been developed from a prototype design by B. Weitz of the Lister Institute of Preventive Medicine. The instrument is believed to have possibilities in many other fields of research and production.

This dispenser consists of 12 separate pumping units to which ungraduated pipettes may be quickly attached. A simple lever movement is used to inspire liquid into these pipettes and to pipette small volumes (up to 1 ml.) into suitable receiving vessels.

Nash and Thompson will also be featuring the production duplex model of the BNF coating thickness meter. It measures non-destructively the thickness of thin films of metal on different base metals, independently of their magnetic properties. It is intended primarily for electro-deposited films. Thickness is indicated on a 4 in. rectangular meter when a hand or jig held probe is applied to the specimen under test, and another electrical contact is made either by a separate clip or through a jig fixture.

The instrument requires to be set up on two samples of known thickness. Calibration samples of nickel on steel are supplied. Subsequently, other standards may be made available, or may be prepared by the user. Provision is made for fitting demountable scales which may be prepared for different metal combinations and for attaching a second probe to the instrument and calibrating its circuit independently of that of the first probe.

Range of the instrument for nickel on steel is about 0.0002 to 0.002 in., and probable error of a single determination is about 10 per cent. Stand 9.

### Oxygen Measurement

Apparatus for the measurement of oxygen consumption in a closed air-circulation system incorporating the soil and root system of a growing plant will be exhibited by the *National Institute of Agricultural Engineering*, Wrexham, Silsoe, Bedfordshire. This apparatus is intended to measure the oxygen used in this manner, so that the minimum permissible rate of oxygen movement through a soil can be estimated. The oxygen content of the air is maintained to within 4 per cent of a predetermined level by the addition of measured amounts of pure oxygen.

A demonstration will also be given of the use of fluorescent substances as

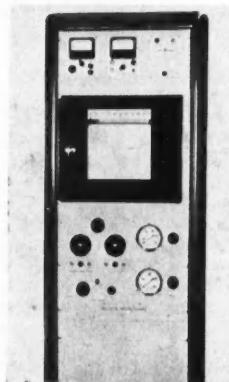
tracers in agricultural and horticultural processes such as crop-spraying and seed-coating.

A remote-reading anemometer has been developed for use in hop-dryer test work at temperatures below 120°F and is required to measure very low air flow. It is a vane-type instrument, employing a phototransistor pick-off, which permits reliable operation at flows down to 20 ft./min. Stand 71.

### New Advance in Gas Liquid Chromatography

A new gas liquid chromatography instrument, to be shown by *W. G. Pye and Co., Ltd.*, Cambridge, is said to give high resolution and high sensitivity. High resolution on short columns for quick analysis provides the optimum system, but until now this has been difficult to achieve because it meant the reduction of the proportion of liquid phase and at the same time the sample size; consequently, components in the order of 1 per cent in a sample size of 1 microlitre went undetected.

The Pye equipment is especially designed for shorter column work. The proportion of liquid phase has now been reduced from the usual 20-30 per cent to 5-15 per cent, thus making it possible to achieve 1,000 theoretical plates per foot of column. This results in a reduction of retention times and consequently quicker analysis and very high separation. The equipment is designed to take up to 4 metres of column, but for most analysis work a single metre column of 3,000 plates is more than adequate to separate the components.



Pye's new gas-liquid chromatograph

In the range 50-250°C the katharometer is controlled to within 0.05°C and the column within 0.5°C. By a simple switching arrangement the temperature of either the column or the katharometer may be indicated on the recorder in two ranges 50-150°C or 150-250°C. The flow rate is measured by means of a soap-bubble manometer. Since the means of measurement is time, very good reproducibility and accuracy of reading is obtained. Stand 99.

### Gas Refrigerator

Among equipment to be shown by *Philips Electrical Ltd.*, Shaftesbury

Avenue, London WC2, is gas refrigerating machine PW. 7000, a small, self-contained, single-cylinder water-cooled gas liquefier, built on the displacer principle, which is unique in obtaining within 15 minutes, temperature in the range of minus 80°C to minus 200°C in a single stage.

The PW. 7000 will liquefy those gases which condense at temperatures above minus 200°C, the rate being determined by the characteristics of the gas or gas mixture. Under atmospheric conditions of 20°C and 50 per cent humidity the output, in the case of liquid air, is 5 litres per hour. The gas to be liquefied does not pass through the working parts, but condenses at atmospheric pressure on the freezer and is drawn in automatically in ratio to the freezing capacity of the machine. The liquid gas is gravity fed from the freezer through an insulated delivery tube which requires no pumping. These features ensure an exceptionally pure product free from oil or contamination.

The PW.7000 is primarily for liquid air production, but the condenser head has been designed to allow it to produce liquid nitrogen by feeding the machine with gas at atmospheric pressure from a nitrogen cylinder. In the case of liquid air production, and depending upon the humidity of the atmosphere, the machine can operate up to, or exceed, 23 hours continuously without interruption, after which defrosting will be necessary. The three principal factors affecting the yield of liquid are, temperature of the gas to be liquefied, temperature of the cooling water and humidity of the gas. Stand 108.

### Oxide and Metal Film Potentiometers

To be featured by *G. V. Planer Ltd.*, Windmill Road, Sunbury-on-Thames, are oxide and metal film potentiometers of the photographically meandered as well as infinite resolution types. Advantages of these elements are said to be high attainable resistance per unit area, good stability and wear characteristics. Temperature coefficients of the oxide type are between 0 and 100 p.p.m./°C maximum, and of the metal film type approximately 300 p.p.m./°C. Resistance values of the 2 in. diameter film potentiometers shown are: oxide type 5 megohm, metal film type 500 K.

Among ferroelectric single crystals to be shown will be barium titanate single crystals with hysteresis loops of improved rectangularity, and niobate crystals. Stand 5.

### Cameras for Automatic Recording of Data

A range of automatic recording cameras and accessories for photographing instrument panels, oscilloscope traces, documents, etc., will be shown by *D. Shackman and Sons*, Chiltern Works, Chesham, Bucks.

The research camera will hold 50 ft. of 35 mm. film. It is fitted with focal plane shutter, interchangeable lenses, daylight loading cassettes and is claimed to be completely automatic in action, re-

quiring only a short electrical impulse for the complete cycle of operation. Power supply is either 12 or 24 volt d.c.

Two oscilloscope recording cameras, types AC/25 and AC2/50 will be shown. They have been specially designed for recording oscilloscope traces using shot by shot and continuously moving film methods. Stand 66.

### Shell's Platinum Resistance Thermometer

Equipment which is purely of a research nature and is not for production or sale will be shown by *Shell Research Ltd.*, PO Box 1, Chester.

An accuracy several times better than that obtainable from thermocouples is claimed for a miniature platinum resistance thermometer which comprises four unsupported helices of 0.001 in. diameter platinum wire housed in a p.t.f.e. former, 3 mm. diameter by 10 mm. long. Resistance at the ice point is about 160 ohms.

A cell for the determination of vapour pressures at temperatures up to 275°C has been developed, consisting of a sample chamber in which the vapour pressure of the sample is balanced against that of a slow stream of nitrogen.

Rapidly changing mechanical parameters such as displacements and pressures can be observed under field conditions in an apparatus which consists of a frequency modulating indicating system by means of which a mechanical variable may be converted into a strictly proportional voltage suitable for application to a pen recorder or oscilloscope. Stand 77.

### Four New Designs Analytical Balances

Analytical balances of a new design will be shown by *J. W. Towers and Co. Ltd.*, Victoria House, Widnes. They are fitted with triangular lacquered brass beams, optically flat synthetic sapphire planes and eight pairs of agate cups and points to ensure smooth action and constant adjustment over a long period. A double arrestment is incorporated so that the load is placed on the outer knife edges before the centre knife is lowered on to the centre plane and the beam allowed to swing. This reduces knife-edge wear.

Four models will be on show: model 60, with a capacity of 20 g. and a sensitivity of 0.1 mg. per scale division; model 97, an air damped balance with capacity of 200 g. and a sensitivity of 0.5 mg.; model 105, which is also air damped and will weigh rapidly and accurately to 0.1 mg.; and model 210, which is a single pan, direct reading, constant load balance with a capacity of 20° g. and a sensitivity of 0.1 mg. Stand 64.

Owing to pressure on space, the remaining accounts of exhibits will be held over until next week.

## DEVELOPMENTS IN UK NUCLEAR POWER PROGRAMME OUTLINED

### Sir John Cockcroft's James Forrest Lecture

IN 1955 Sir John Cockcroft gave his first James Forrest Lecture to the Institution of Civil Engineers. His subject then was on the 'Development of nuclear power.' On Tuesday this week Sir John delivering the 1958 James Forrest Lecture, chose as his subject the 'Further development of the UK nuclear power programme.'

The first important change, Sir John noted, had been in output of individual nuclear power stations. Increased output at Calder Hall had been achieved first by an increase in reactor size and a corresponding increase in the amount of uranium fuel. Second, by an approximate doubling of the amount of heat extracted from each ton of uranium. This increase in rating had been achieved by increasing the fuel element surface temperature from 410°C to about 425°C, by a 50 per cent increase of the pressure of the carbon dioxide heat transfer gas and by improvements to the heat transfer surface.

Fuel elements performance was the key to the performance of any reactor, stated Sir John. He referred to the phenomenon known as the Cottrell effect. This had been noted at Calder Hall and it had been necessary to fix stays to the fuel elements to overcome this.

During the 27 months of operation of the first charge of No. 1 reactor, only three fuel elements out of 10,000 developed slight faults in the sheath, resulting in a slow leakage of carbon dioxide leading to slow oxidation of the uranium metal.

#### Reactor Safety

A 'good deal of effort' was being devoted to ensuring that Calder Hall and future Electricity Board reactors could be operated safely at all times. The Windscale accident had focused attention on the storage of energy in graphite (the Wigner effect). The lowest graphite temperature of the Electricity Board reactors would be about 20°C higher than Calder Hall so that the time before annealing would be required should be much longer and might approach the 20-year assumed life of the reactor.

Among safety requirements mentioned by Sir John was that any blow-down circuits were properly protected by filters which could take out a large proportion of any particulate fission products.

Detailed design study had been carried out in the last three years on the liquid sodium-cooled, graphite-moderated reactor. This had the potential attraction of attaining high outlet coolant temperature—of the order of 500°C with corresponding high thermodynamic efficiencies—of the order of 37 per cent. Fuel, in this case, would be expensive as enriched uranium was required. However, the possible

economic disadvantages of the sodium graphite reactor did not seem to outweigh its serious development and maintenance problems.

Consideration was given by Sir John to the pressurised water and boiling water reactors of the US and USSR nuclear power programmes. The water-moderated reactors had the disadvantage that enriched uranium fuel had to be used. Outside the US this type of uranium fuel would be much more expensive, therefore the UK was not pursuing this reactor for large-scale power.

Two future lines of development being investigated at present in the UK were the development of the gas-cooled graphite-moderated reactor and the possible advantages of a change to heavy water as a moderator. The first of the projects is known as the advanced gas-cooled reactor (AGR).

Objective of the AGR is to decrease capital costs per kW by a substantial amount—of the order of 30 per cent—by increasing the surface temperature of fuel elements to about 600°C. To obtain this temperature there will be a change from uranium metal fuel to a sintered uranium oxide fuel element (melting point of about 2,400°C). The UO<sub>2</sub> fuel elements would probably be sheathed in beryllium. A first specimen of such a canned element was now going into DIDO to determine irradiation stability. Overall fuel costs are estimated to be about the same as the first generation reactors—about 0.16d per unit. The target was 0.47d for the late 1960's.

A promising alternative to the AGR was the heavy water-moderated gas-cooled reactor. This had the potential advantage of a smaller reactor size than the graphite-moderated reactor leading to lower capital costs. Because of the favourable neutron economy of these reactors, only slight enrichment would be required and fuel costs would be lower than for the AGR. Reactivity temperature co-efficient problems would also be reduced.

Substantial quantities of heavy water would be required for this reactor. Present US cost of heavy water was about £20,000 a ton. Investigations carried out at Harwell during the last few years had shown it would be possible to produce heavy water at comparable prices in the UK and other European countries. Overall economics of this reactor should be as favourable as the AGR.

Ultimate development of the gas-cooled reactor would substitute all ceramic fuel elements for the designs using metal sheaths which might allow outlet gas temperatures to be increased to about 700°C resulting in further increases of ratings. The UK AEA were therefore

attempting to develop impervious ceramic sheaths for a fuel element which is a ceramic—a mixture of graphite, uranium and thorium. A zero energy experiment was being built at Winfrith Heath to enable the nuclear properties of the reactor at high temperatures to be studied.

Fast reactors had the objective of increasing the utilisation of uranium a hundredfold over the thermal reactors. By-product plutonium from thermal reactor stations could be fed to fast reactors. The fast reactor might turn out to be the most economical method of utilising by-product plutonium. With the coming into commission of the Dounreay 60 MW (thermal) fast reactor, this question will be resolved.

Finally, Sir John said that in the long run fusion reactors might replace fission reactors; and certainly the final objective should be to use the energy available from fusion reactions in deuterium.

### Sir A. Fleck Opens SAI's Fertiliser Plant

SCOTLAND is now consuming nearly three times as much fertiliser as before the war and five times as much lime, said Sir Alexander Fleck, at the inauguration of Scottish Agricultural Industries' new fertiliser works at Leith (see p. 539). Sir Alexander, who is chairman of Imperial Chemical Industries Ltd., and a former chairman of SAI, went on to say that these increases by no means represented the maximum amount that the farmer could profitably add to Scottish soil.

For instance, much grassland could be more intensively farmed if it were dressed with more nitrogen, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O. This was especially important in the north because of the large part that that crop played in Scottish agriculture.

Sir Alexander's view is that the productivity of Scottish farms has been increased and will be further increased by the application of engineering, biological and chemical methods. SAI's Leith works, he said, would do something towards providing the help that chemistry could give the farmer. In doing so, it would make an indirect contribution to the UK's permanent balance of payments problem.

About 43 per cent of total UK exports went towards the bill for imported food and feeding stuffs, he said. Calculations showed that at present prices the UK could save about £50 million a year on imported cattle feed if its grassland could be utilised to the full.

### Micro and Semi-micro Methods at Norwood

A course of 12 lectures with practical work on micro and semi-micro chemical methods will be held on Saturday mornings at Norwood Technical College, London SE27. Starting on 19 April, they will run from 9.15 a.m. to 12.30 p.m. Application forms and a detailed syllabus can be obtained from the secretary of the college.

## Overseas News

## DU PONT'S ANNUAL REPORT SHOWS NEW RECORD IN SALES

IN 1957 the Du Pont company spent \$220 million in construction and expansion of plants, laboratories, and service units, and attained sales of \$1,965 million, both record highs for the company. This is disclosed in the annual report.

Despite decreased business activity in the fourth quarter, sales for the year were 3 per cent above the previous record year of 1955 and 4 per cent ahead of 1956.

Net earnings from operations increased 4 per cent over 1956, but an 8 per cent rise in average operating investment resulted in a return on operating investment of 11 per cent compared with 11.3 per cent the previous year.

Earnings were \$397 million in 1957 compared with \$383 million in 1956, including \$116 million from General Motors dividends in each of the two years. Dividends paid on the common stock were \$6.50 a share, the same as in 1956.

Expenditure of \$220 million on new and expanded plants, laboratories and service units was an increase from \$157 million for 1956. Due principally to this, the average gross operating investment increased from \$2,252 million for 1956 to \$2,421 million for 1957.

Six new plants are under construction. Among the products involved in the expansion at these and other locations are nylon, Orlon acrylic staple, cellophane, titanium pigments, Alathon polyethylene resin, Dacron polyester fibre, sodium, silicon, Mylar polyester film, Teflon tetrafluoroethylene resin, sulphuric acid, neoprene synthetic rubber, tetraethyl lead anti-knock compound, sodium carboxymethyl cellulose, sulphonic acid, and Hypalon synthetic rubber.

During the year \$80 million was spent on research and development, exclusive of laboratory construction and technical assistance to manufacturing and sales. Research and development were carried forward by 2,200 scientists at 30 laboratory locations.

## Linde Oxygen Plant to Supply Detroit Steel

An automatically-operated oxygen plant is to be built at the site of Detroit Steel's operations at Portsmouth, Ohio, by Linde Co., division of Union Carbide Corporation. The plant will produce 20,000,000 cubic feet of high-purity (99.5 per cent pure) gaseous oxygen a month for use in furnace operations as well as normal steel mill activities.

The new oxygen plant is designed for automatic, unattended operation. Through a unique control system, the plant will automatically produce oxygen at the rate required by Detroit Steel's operations, pump oxygen into storage tanks for standby and 'peak' requirements, and regulate the operation of a host of valves, meters, motors, switches, etc. An elec-

tronic monitoring system, reporting continuously to a central office, keeps track of the operation of all important components to detect possible troubles in advance.

At present Detroit Steel is receiving between five and seven million cubic feet of high-purity oxygen a month all transported from Linde mass-producing plants. Expansion of activities plus a greater use of oxygen in the steel furnaces will increase the oxygen needs of the mill. The new producing plant is expected to go on-stream in 1958. Until that time Linde will supply all necessary oxygen via the Driox system.

## French Maleic Anhydride Production

At Villiers St. Paul, some 50 kilometres north of Paris, the Kuhlmann subsidiary Cie Française des Matières Colorantes (Francolor) Paris, have a large scale plant for the production of maleic anhydride. Capacity is about 1,000 tons a year. The unit will manufacture the requisite catalysts and use the process evolved by the Scientific Design Co., New York US. It is a continuous process of oxidation of benzene vapour direct to maleic anhydride.

## Swedish Fertiliser Production

Fertiliser manufacturers, AB Svenska Salpeterverken, Kopings, Sweden, have nearly doubled their sales in the last two years; Kr.23m. (£1.1 million) in 1956-7 compared with Kr.13m. two years ago. The major output is calcium ammonium nitrate (130,000 tons containing 20 per cent N) and complex fertiliser (70,000 tons of composition containing 13 per cent N, 10 per cent P<sub>2</sub>O<sub>5</sub> and 13 per cent K<sub>2</sub>O). The main raw materials are ammonia (12,000 tons are produced within the company and 22,000 tons come from Svenska Skifferolje) and imported rock phosphate and potash. Other products sold are nitric acid, carbonic acid, dry ice and ammonium bicarbonate. CO-conversion catalyst is also made, mostly for export to ammonia plants and oil refineries.

## De La Rue's Australian Subsidiary Operating

Thomas De La Rue (Aust.) Pty, the Australian subsidiary of Thomas De La Rue and Co., formed with a capital of £A.1 million in 1956 for the manufacture of Formica laminated plastics, have now begun operations. Mr. R. G. Menzies, the Prime Minister, performed the opening ceremony last week at the company's site at Thornleigh, near Sydney.

Ownership of the Australian factory will

in due course be transferred to Formica, the De La Rue subsidiary in which American Cyanamid Co. has a minority shareholding. It is also reported that Electricity Meter and Allied Industries of Australia (Email) have agreed to take up a substantial shareholding in the new company and will be represented on the board.

## Belgium Venue for Industrial Chemistry Congress

The annual congress of industrial chemistry, organised by the Société de Chimie Industrielle, Paris, is to be held in Liège, Belgium, this year, from 7 to 20 September. Under the grouping of 'general technical problems of the chemical industry' there will be six sections. They are: analytical chemistry, chemical engineering and control, corrosion, water treatment, lubrication and refrigeration. Other groups will meet to discuss fuels; nuclear sciences; metallurgy; industrial chemistry of minerals; cements, building materials and glassmaking; organic chemical industries; food and agricultural industries; colonial problems; and industrial and social organisations.

## Greek Uranium Deposits

It is reported from Greece that important deposits of uranium and thorium have been discovered in Western Thrace. Ores prospected have shown higher uranium and thorium content than those found in the US.

## BP's New Canadian Refinery

For BP's new \$30 million refinery in Canada at Ville d'Anjou, Montreal, a new BP company has been formed to own and operate it. It will be incorporated in Canada with headquarters in Montreal.

Input of the refinery will be 25,000 barrels a day (over 1 million tons a year). Main processing plant will include a crude oil distillation unit, a catalytic reclaimer, a catalytic cracker with an associated polymerisation unit, and a hydro-desulphuriser.

Construction work, to be carried out by the Luminus Co. of Canada, is to begin within the next six months. The refinery is due to be completed and in operation by the middle of 1960.

## Automatic Ovens Speed Uranium Oxide Production

At the Hanford atomic plant near Richland, Washington, US, automatic ovens are being used to speed up the production of uranium oxide. Designed and installed by engineers of the General Electric Co., who operate the big plant for the US Atomic Energy Commission, the 'ovens' are new-type calciners, replacing old batch kettles in the production of UO<sub>3</sub>.

Molten uranium salt is fed into the calciners where extremely high temperatures created by electric heating elements 'bake' the salt and reduce it to uranium oxide, a powder suitable for easy shipment to other atomic installations.

Recovery of valuable unfissioned uranium from dissolved irradiated fuel elements, while secondary to the plant's main job of making plutonium, nevertheless

less is a vital function of Hanford. The reclaimed uranium is processed and can be refined into metal for nuclear reactors, or into chemicals for gaseous diffusion plants.

The new calciner furnace is never shut down for unloading operations. The oxide is discharged continually through a hopper while fresh molten salt pouring in from above maintains a constant balance in the oven. High temperature acidic gases escape through special filtered exhaust pipes and no one is exposed to radiation or radioactive contamination. Agitator paddles constantly stir up the mixture and prevent it from crusting on the sides of the oven.

General Electric engineers combined high grade stainless steel with certain design techniques to overcome corrosion and temperature problems. The result was a calciner that would stand up under temperatures of 1,000°F and resist corrosion from acidic gases.

### New \$119 Million Project for Freeport Sulphur

Freeport Sulphur Co.'s nickel-cobalt project, to use ores mined and concentrated in Cuba and refined in Louisiana, is scheduled to be operating in the summer of 1959. This \$119 million investment will have a yearly productive capacity of 50 million lb. of nickel and 4.4 million lb. of cobalt.

### Dollar Loan for Sicilian Mineral Industry

Out of a total \$75 million loan granted to the Cassa per il Mezzogiorno by the International Reconstruction and Development Bank, Washington, more than \$24 million is earmarked for the mineral industry in Sicily. \$6 million has been allocated to Montecatini for a project at Caltanissetta; a similar sum to Societa' Trinacria for the production of potassic salts near Enna; and \$12,800,000 to Sincat for the development of kainite mines near Siracusa.

### Heat Resistance of Du Pont's New Synthetic Rubber

Development of a new type of synthetic rubber, Viton, with marked heat resistant qualities has been announced by E. I. Du Pont de Nemours and Co.

Commercial production of Viton is due to begin at a new plant at Deepwater, New Jersey, next month. The new rubber is based on petroleum and fluorine gas. It is made from vinylidene fluoride and hexafluoropropylene.

Tests are stated to show that this synthetic rubber can stand up to a heat of 400°F for more than 100 days and up to 600°F for 25 hours. It is also claimed that it is resistant to most corrosive chemicals and solvents including some of the new high energy missile fuels.

Du Pont say that Viton has already been incorporated in some industrial products such as new super-duty Ford truck engines that run at very high temperatures and have sodium-cooled exhaust valves, in seals for aircraft and engine and pumps developed

for blending high octane petrol at service stations.

Uses envisaged for Viton are in fuel cells in aircraft wings, aircraft tyres, hose for fuels and corrosive chemicals, protective clothing, fire walls in aircraft, pumps and valves and in paint for missiles and aircraft. Initial price of Viton will be about \$15 a pound.

### Making Synthetic Fibres Dye-receptive

Dow Chemicals, US, who have been reported as copolymerising vinyl pyrrolidene with acrylonitrile to make Zefran fibre dye-receptive, are said to be interested in the Societe Polyplastic method of graft-polymerising acrylic and isotactic fibres. In the French process, the polymers are treated with ozone prior to surface-grafting vinyl, vinylidene and diene monomers. This process is stated to make the fibres dye-receptive.

### New Rohm and Haas Plasticisers

Paraplex AP-176, a new polyester plasticiser developed by Rohm and Haas Co., Philadelphia 5, Pennsylvania, US, is said to combine the well-known permanence of the Paraplex series with excellent compatibility in vinyl systems and modest cost. Paraplex AG-176 is being recommended to vinyl compounders who require the maximum in resistance to solvent extraction. Newest additions to Rohm and Haas's Monoplex epoxy stabilising plasticisers series is Monoplex S-73. It is stated to impart to polyvinyl chloride a combination of heat and light stability, excellent retention of flexibility at low temperatures, and low volatility not previously available at a moderate cost. Claims for economy stem from the relatively low price of the compound and its low specific gravity (0.9180 at

25°C). Due to its low volatility (approximately one-third less than that of diethyl sebacate) it is not lost on the mill or calendar. The properties of Monoplex S-73 are summarised as follows: excellent low temperature flexibility; excellent stabilisation against heat and ultra violet light degradation; better permanence through low volatility; economy due to moderate price and low specific gravity; low initial viscosity and good viscosity stability in dispersion compounds; good compatibility and retention of compatibility under severe exposure conditions; excellent colour (varnish scale 2.0 maximum) and clarity; and better resistance to migration than that normally shown by low temperature plasticisers.

Use of Monoplex S-73 is suggested in many applications in which the performance of polyvinyl chloride compounds containing other low-temperature plasticisers has not been completely satisfactory.

### Overseas Firms Seek UK Agencies

Quimica Agricola del Pacifico SA de CV Aptdo. Postal 868, Mexicali, B.C. Mexico are interested in representing UK suppliers of agricultural insecticides and fertilisers.

Bate Chemical Corporation Ltd., 184 Laird Drive, Toronto, 17, Ontario, a firm of industrial chemical wholesalers, wish to contact UK manufacturers of industrial chemical products which could be added to their existing range. The Canadian company are prepared to handle suitable products on an agency basis or by manufacture in Canada under licence.

Gebrueder Schoeller, Vienna 1, Rennagasse 3, are interested in plastics raw materials, polyamides and polyurethane, and would like to get in touch with a UK manufacturer with a view to taking over its representation for Austria.

### Crystallinity of Isotactic Polypropylene Estimated

TWO RUSSIAN authors in a recent paper (1) have described the results of the determination of the infra-red spectra of a number of samples of isotactic polypropylene prepared by different methods. From these results they have estimated the degree of crystallinity of three of the samples.

The spectra were recorded over the range 700-3000 cm<sup>-1</sup>, using films of polymer 0.2mm. thick, on rock-salt and lithium fluoride prisms. With the apparatus used it was possible to maintain the film of polymer at various temperatures within the limits 20°C to 200°C.

Altogether the following absorption bands were found: 720, 730, 810, 839, 894, 935, 969, 992, 1050, 1108, 1170, 1376, 1460, 2850, 2875, 2924 and 2957 cm<sup>-1</sup>. All of these bands were not found in all samples. In the range 830-1000 cm<sup>-1</sup> the spectra were coincident with those of Natta and co-workers (2) who confined their measurement to this region.

Bands at 894 and 992 cm<sup>-1</sup> appear to

be characteristic of crystalline polymers. They disappear on heating the samples to about 170°C, which is in the region of  $T_m$ , the 'melting point' of polypropylene crystallites. They are also very weak in the fraction of the polymer extractable by ether.

The content of amorphous polymer and hence, by difference, the degree of crystallinity of three samples was found by comparing the optical density of the band at 790 cm<sup>-1</sup>, measured at a polymer temperature of 20°C, with that found above. This band is characteristic of amorphous polymer. The results indicated degrees of crystallinity of the order of 75, 90 and 100 per cent respectively. Great numerical accuracy is not claimed; the figures merely indicate that the degree of crystallinity in isotactic polypropylene is very high.

#### REFERENCES

- (1) Pokrovskii and Volkenstein. *Dok. Akad. Nauk.* 1957, 115, 552.
- (2) Natta et al., *La Chim. e L. Ind.*, 1956, No. 2, 124

# FAO Reviews World Fertiliser Production and Consumption

DATA on fertiliser production and consumption up to 23 September 1957 is contained in the 'Annual review of world production and consumption of fertilisers 1957' just published by the Food and Agricultural Organisation of the United Nations. The information in this review has been based on questionnaires returned by all member Governments. Details of fertiliser prices, subsidies and other economic aspects of fertiliser use will be presented in a review to be compiled by FAO's economic division. This present FAO review is published (20 March) by HM Stationery Office, price 5s.

Total world production of nitrogen, phosphoric acid and potash from 1955 to 1957 is given in Table 1. The increase in total production of all fertilisers in 1956, over 1955 (5 per cent), was less than that in recent years. The estimated increase in 1957 is somewhat lower still.

**Nitrogen production:** The increase in production of nitrogen in 1956 (7 per cent) was only two-thirds of that in 1955. The increases in phosphoric acid and potash were only about half those in 1955. The trend shown in recent years for nitrogen and potash production to catch up on phosphoric acid was again evident for nitrogen in 1956, but not so much for potash. Estimates for 1957 put nitrogen production at 99 per cent of that of phosphoric acid, while for potash it is 90 per cent. FAO's review shows that an annual increase in production averaging 8 to 9 per cent has occurred in Europe over the period and that in 1956 that continent still produced just over half the world's nitrogen supply. In North America, where all fertiliser production and consumption data are dominated by the US, the continent produced nearly one-third of the world's total nitrogen in 1956. The high rate of increase in 1956 has been followed by a sharp drop to only 2 per cent in 1957 and to a 1 per cent forecast for 1958.

## P<sub>2</sub>O<sub>5</sub> Levelling Off

**Phosphate production:** Not all returns on production of phosphate rock for 1957 have been received. In 1956, production of this fertiliser increased by nearly 12 per cent. The US still produced about 50 per cent of the world supply. Excluding ground phosphate rock prepared for direct application, Europe in 1956 produced nearly 40 per cent more phosphoric than North America, and together these still represent four-fifths of the total world production. Phosphoric acid production is now showing a definite tendency to level off. Only Asia and Africa show any further appreciable increases, while the variations for S. America and Oceania are erratic from year to year.

**Potash production:** Europe still produces over 70 per cent of the world's supplies of potash fertilisers with practically all the rest being produced in N. America. Both these areas show a small but steady increase and Asia is beginning to make a

small but significant contribution with the starting up of the Dead Sea plant in Israel.

**Forms of nitrogen fertilisers:** The principal forms of nitrogen fertilisers produced in the six continents were: ammonium sulphate, ammonium nitrate, calcium nitrate, sodium nitrate, cyanamide, 'other forms' (solids and solutions) and organic materials (i.e. complete or complex fertilisers of unspecified composition). Little change has occurred in the relative proportions of the various forms over the three years 1955-1957. Production of anhydrous ammonia or aqua ammonia has only slightly expanded in the US; in 1956 such solutions provided over 16 per cent of the world production of nitrogen.

**Forms of phosphate fertilisers:** Single superphosphate and basic slag are the main phosphate fertilisers and Europe is the main producer. (Table 3)

**Forms of potash fertilisers:** These include potassium sulphate (48-52 per cent K<sub>2</sub>O);

potassium chloride ((a) exceeding 45 per cent K<sub>2</sub>O; (b) 20-45 per cent K<sub>2</sub>O); crude potash salts, up to 20 per cent K<sub>2</sub>O and other potash fertilisers. In W. Germany, Spain and the US, the greater part of potash production was in the form of potassium chloride exceeding 45 per cent K<sub>2</sub>O.

**World consumption of fertilisers:** Percentage increases for all fertilisers together (N + P<sub>2</sub>O<sub>5</sub> + K<sub>2</sub>O) in 1956 and 1957 are rather higher than those estimated or forecast in the 1956 FAO review. In 1956, 11 per cent more nitrogen was used than in 1955. Phosphate and potash each showed an increase of 5 per cent in 1956. However, the further increases estimated for 1957 and forecast for 1958 all indicate a smaller rate of growth in total consumption than 1956.

FAO suggest that fertiliser consumption as a whole may still be expected to continue to increase annually by about 6 per cent during the next few years, having regard to the fact that estimates and forecasts for 1957 and 1958 are on a conservative basis.

While Europe and N. America continue to account for over three-quarters of the world total consumption of nitrogen fertilisers, Europe shows a higher and more sustained rate of increase than N. America,

(Continued on page 562)

Table 1  
World Production of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O 1955-57

Type of fertiliser	Production			Increase from	
	1955	1956	1957	1955 to 1956	1956 to 1957
Thousand metric tons					
All fertilisers (N + P <sub>2</sub> O <sub>5</sub> + K <sub>2</sub> O)	19,230	20,179	20,927	5	4
Nitrogen (N)	6,225	6,090	7,143	7	7
Phosphoric acid (P <sub>2</sub> O <sub>5</sub> )	6,879	7,147	7,242	4	1
Potash (K <sub>2</sub> O)	6,124	6,342	6,542	4	3

Table 2  
Nitrogen Fertiliser Production and Rate of Increase

Continent	Production				Increase from		
	1955	1956	1957	1958	1955 to 1956	1956 to 1957	1957 to 1958
Thousand metric tons of N.							
Europe	3,140	3,404	3,713	n.a.	8	9	n.a.
North and Central America	2,015	2,193	2,247	2,275	9	2	1
South America	284	227	225	242	-2	0	1
Asia	737	813	889	997	10	9	12
Africa	29	36	43	43	24	20	0
Oceania	19	18	25	25	-5	41	0
World Total	6,225	6,690	7,193	n.a.	7	7	n.a.
n.a. = not available							

Table 3  
Phosphate Fertiliser Production in 1956 and 1957

Fertiliser	Year	Europe	N. America	S. America	Asia	Africa	Oceania	Total	
								Thousand metric tons P <sub>2</sub> O <sub>5</sub>	
Single superphosphate (less than 25% P <sub>2</sub> O <sub>5</sub> )	1956	1,510	1,479	—	336	188	671	4,184	
	1957	1,496	1,452	—	335	216	591	4,100	
Double superphosphate (more than 25% P <sub>2</sub> O <sub>5</sub> )	1956	164	712	—	1	91	—	968	
	1957	166	677	—	—	108	—	951	
Basic slag	1956	1,053	—	—	1	8	—	—	1,062
	1957	1,112	—	—	3	10	—	—	1,125
Others	1956	455	209	52	83	2	—	—	801
	1957	546	282	46	87	2	—	—	963

Table 4  
World Consumption of Nitrogen, Phosphoric Acid and Potash 1955-58

Fertiliser	Consumption				Increase from		
	1955	1956	1957	1958	1955 to 1956	1956 to 1957	1957 to 1958
Thousand metric tons							
All fertilisers (N + P <sub>2</sub> O <sub>5</sub> + K <sub>2</sub> O)	17,983	19,339	20,097	20,588	7	4	2
Nitrogen (N)	5,640	6,288	6,601	6,848	11	5	4
Phosphoric acid (P <sub>2</sub> O <sub>5</sub> )	6,747	7,104	7,324	7,470	5	3	2
Potash K <sub>2</sub> O	5,596	5,950	6,172	6,270	5	5	2

\*From 1956 review (revised figures)

● The City and Guilds of London Institute has conferred a special annual award on DR. ARTHUR MARSDEN, area scientist to the South Western Gas Board. Dr. Marsden has held appointments at Bristol University. He is a past vice-president of the Society of Chemical Industry and was the society's Jubilee Memorial Lecturer in 1955.

● DR. J. W. CORRAN, chief chemist of J. and J. Colman, Norwich, is to leave for Pakistan on 29 March. He has accepted an invitation from the Food and Agricultural Organisation of the United Nations to spend a year helping Pakistan to set up a number of food research laboratories.

While he is there he will be working for the Pakistan Council of Scientific and Industrial Research dealing with the building, equipping and deciding the scope of the laboratories as well as trying to assemble a staff of scientists and helping with the training of students. His assignment covers both East and West Pakistan, with headquarters at Lahore and other centres including Peshawar, on the North West Frontier, Karachi and Dacca. J. and J. Colman Ltd. have granted Dr. Corran a year's leave of absence.

● Three new chairmen of British Standard Institute industry standards committees have recently been made. MR. L. W. BLUNDELL, by-products controller, North Thames Gas Board, is to be chairman of the tar committee, MR. W. E. CASH, assistant managing director of the chemical division, Distillers Co., is to be chairman of the fine and heavy chemicals committee, and MR. L. F. COCKROFT, director of John Cockcroft Ltd., is to be chairman of the cotton committee. Mr. Cockcroft is also chairman of BSI's textile divisional council.

● MR. DONALD L. FORBES has been appointed a director of the Graviner Manufacturing Co. He has been associated with the company since 1936.

● DR. B. D. THOMAS has been appointed president of the US Battelle Memorial Institute in succession to DR. CLYDE WILLIAMS, who retired recently. Dr. Thomas joined Battelle as a research engineer in 1934, and was appointed assistant director in 1942 and vice-president in 1955. He was made a director last year.



Professor F. C. Frank, right, of the W. H. Wills Research Laboratory, Bristol University, at the Heald Green Laboratories of the British Rayon Research Association where he recently gave a lecture on 'How crystals grow'. With him is L. A. Wiseman, BRRA director

# PEOPLE in the news

● As foreshadowed in his recent review accompanying the annual accounts, MR. DESMOND ABEL SMITH has now resigned his appointment as chairman of Borax (Holdings) Ltd. after 20 years in that office, but remains on the board. LORD CLITHEROE, who has been a director for 11 years and deputy chairman for the last three years, has now been elected chairman, and MR. FREDERICK A. LESSER has succeeded Lord Clitheroe as deputy chairman while continuing to occupy the position of managing director.

● MR. F. G. BREWER, O.B.E., who has been secretary to the Gas Council since its formation in 1948, will retire from that office at the end of September. MR. WILFRID BAILEY, chief accountant of the Council, has been appointed to succeed him.

● MR. E. BARLOW, sales manager since 1956 of the Industrial group of Dunlop's general rubber goods division, has taken up a new appointment as manager of the division's midland region at Birmingham in place of MR. E. BOWKER, who has become assistant to the sales manager in Manchester. He is succeeded by MR. J. K. COLLINS, the group's assistant sales manager.

● DR. R. BELCHER of the department of chemistry, Birmingham University, was elected chairman of the Midlands section of the Society of Analytical Chemistry at their AGM on 4 March. Vice-chairman is DR. S. H. JENKINS, chief chemist of Birmingham Tame and Rea District Drainage Board, and hon. treasurer is MR. F. C. J. POULTON. The hon. secretary is MR. G. W. CHERRY of 48 George Frederick Road, Sutton Coldfield, Warwickshire.

● MR. G. H. BLACK, a director of the Kestner Evaporator and Engineering Co. Ltd., flew from London on 21 March, for a short visit to the US where he is having conversations with a number of firms.

● MR. R. L. PAICE, who has been sales director of Igranic Electric Co. Ltd., Bedford, since 1948, relinquished this position on 1 March. MR. A. W. PAGE, as sales manager, is now responsible for the home and export sales organisation. Mr. Paice remains a director of the company and will carry out special assignments.

● DR. J. MASEK of the Polarographic Research Institute, Czechoslovakian Academy of Sciences, is seen below on his arrival at London Airport on Tuesday evening this week. Dr. Masek brought with him a two-hour film on polarography which he showed at the symposium 'Education in polarography', organised by the Polarographic Society at Birmingham on Thursday.

The film is also being shown to the RIC at Seascake, Cumberland, on Friday, to the SAC at Glasgow on the following Monday and the RIC Belfast on Wednesday. On Friday 28 March it will be shown at the Royal School of Mines, London SW7; this meeting is open to the general public.



Dr. Masek at London Airport

## Russians to Visit UK Gasification Plants

A PARTY of Soviet experts in the underground gasification of coal, together with a woman interpreter, arrived at London Airport on 13 March for a two weeks visit as guests of the National Coal Board.

Technical members of the party who were met at London Airport by Mr. J. Norval, chairman of the NCB underground gasification executive, and leader of the UK team, are N. V. Kalmikov, head of technical department, Glavgas (the organisation controlling the USSR's gas industry); O. V. Kruglov, director, Lischansk Underground Gasification Station; N. A. Federov, director, Vnijipodzemgas Institute (underground gasification research); and N. V. Lavrov, deputy director, Institute of Combustible Miners.

During their stay in this country they will see the experimental underground gasification site at Newman Spinney, Derbyshire. Other visits will include the Coalite works at Bolsover, Sheffield University to see research work by the department of fuel technology and chemical engineering, the coal gasification plant at Kensal Green, the oil gasification plant at Fulham, the Gas Council's Research Station at Solihull, the NCB Mining Research Establishment at Isleworth, Power Gas Corporation, Stockton, the British Coal Utilisation Research Association at Leatherhead, and the DSIR Fuel Research Station at Greenwich.

The party is due to return to Moscow on 30 March.

## Commercial News

## Bakelite's Profit Balance After Tax Shows Improvement

**PROFIT** balance for Bakelite Ltd., manufacturers of plastics materials, after all charges including tax, shows an improvement of £225,472 for 1957, compared with the previous year's £209,989.

In the year to 31 December last, the depreciation provision was £239,747 (£190,799), scientific research £19,479 (£17,367). Special obsolescence £17,712 (nil) and exceptional revenue expenditure incurred in connection with the vinyl resin plant rehabilitation, £108,137 (£53,042), less provisions and adjustments from previous years £95,259 (£53,042). There were credits of £37,191 (£17,367) from previous years' provisions. Taxation was lower at £156,200.

Bakelite are maintaining their 1957 ordinary dividend at the reduced 15 per cent, paid for the previous year, with an unchanged 10 per cent final. The 1955 total was 16 per cent.

### W. G. Pye and Co.

Treasury consent is being sought by W. G. Pye and Co. Ltd. for a debenture issue. At the company's meeting last September it was concluded that a substantial funding operation was necessary in order to reduce bank overdrafts. It is proposed to raise group borrowing powers to 1½ times the share capital and consolidated reserves. On the basis of the last published accounts the new limit would be £11,043,225 which would be increased from time to time, against a present limit of £5,302,758.

Increase in borrowing (£3,311,630 at 31 March 1957 and £5,042,389 on 28 February last) has resulted mainly owing to the need to finance increased exports, particularly of capital equipment, certain large Government contracts in the atomic and guided missiles field, and longer credit in the home market due to the credit squeeze.

### British Industrial Plastics

Details of trading profits, etc., for British Industrial Plastics were reported in CHEMICAL AGE, 1 March, p. 404. At the annual general meeting held in London on 13 March, Mr. E. R. Crammond, chairman, said that thanks to improved manufacturing methods and a first-class sales force the company in 1957 not only increased its turnover but retained the same relationship between profit and turnover as in the previous year. While the group's turnover had increased from £3,650,000 to £6,500,000 during the last six years, the number of workpeople and staff employed had only risen from 2,100 to 2,300. The good trading results had been accomplished without increasing the price of the main

products of the group's chemical factories

The building and plant for the Filon process, of glass fibre reinforced polyester resin sheeting, had been erected and installed expeditiously.

Sales and profits for the first quarter of this financial year were described by Mr. Crammond as satisfactory and were running at a higher level than in the previous year. The position as regards orders was sound.

### Courtaulds (Australia)

Following higher profits gained in the half-year to 31 December 1957, Courtaulds (Australia) have raised their interim dividend from 2 to 2½ per cent.

The directors have reported that demand for the company's products was well sustained during the last half-year. Buyers of textile yarns were now reducing forward commitments, however, until future conditions arising from the Japanese trade agreement had clarified. Orders for tyre cord fabric were stated to be satisfactory.

### Shawinigan Chemicals

The wholly-owned subsidiary Shawinigan Chemicals, of Shawinigan Water and Power Co., is stated in the annual report to have been affected by the unsettled conditions existing throughout the chemical industry in Canada and profits were lower.

In the UK, sales of vinyl acetate by Hedon Chemicals, an associated company of Shawinigan Chemicals, are stated to have increased at a satisfactory rate.

Working capital at the end of the year for Shawinigan Water and Power Co., totalled £16,052,891, compared with £20,477,109 at end-1956.

St. Maurice Chemicals Ltd. is to become wholly-owned by Shawinigan Chemicals Ltd. At present the St. Maurice company is owned jointly by Shawinigan Chemicals, itself a wholly-owned subsidiary of The Shawinigan Water and Power Co., and by Heyden Newport Chemical Corporation, of New York.

To carry out the purchase, The Shawinigan Water and Power Co., subject to approval of the Provincial Electricity Board, proposes to issue 75,000 additional common shares to exchange for Heyden Newport's 50 per cent interest in St. Maurice Chemicals. Shawinigan Water and Power then plans to transfer this interest to Shawinigan Chemicals in exchange for additional Chemicals common stock.

St. Maurice Chemicals, with a plant at Varennes, Que., manufacture formalde-

hyde and pentaerythritol. The merchandising division is the McArthur Chemical Co. which deals in a wide variety of chemicals. St. Maurice Chemicals use raw materials supplied by Shawinigan Chemicals and their products go into the same fields as those of Shawinigan Chemicals—the paints and plastics industries.

Under the proposed arrangement Heyden Newport patents and know-how will continue to be available to St. Maurice and both the manufacturing and merchandising divisions will continue to operate without change in policy or personnel.

### Aspro Nicholas Ltd.

Trading results of Aspro Nicholas Co. Ltd. for the nine months to 31 December last continued to be satisfactory and group profit for the year to 31 March is expected to be higher than it was in the previous year.

An unchanged third interim dividend of 6 per cent has been declared. Four such payments were made for 1956-57.

Because of seasonal fluctuations in the trade at home and overseas and the possibility of drawing misleading inferences from comparisons of such short-term quarterly figures the board have decided that publication of short-term quarterly figures is not in the company's interests and will be discontinued. Quarterly dividend payments will remain unchanged, however.

### Joseph Crosfield

Soap and chemical manufacturers, Joseph Crosfield and Sons, controlled by Unilever Ltd., report that net profit is £883,349 (£923,567) after charging tax of £980,240 (£1,069,785). Ordinary dividend for 1957, after deducting income tax is 25 per cent (same).

### Thomas De la Rue

The one-for-one scrip issue, the consolidation of the 5s unit into 10s shares and amendments of the articles of Thomas de la Rue have been approved unanimously.

### Wm. Briggs and Sons

The directors of William Briggs and Sons, manufacturers of bitumen products, announce that CIC consent has been received for the one-for-one ordinary scrip issue. This will capitalise £350,000 of reserves.

### NEW COMPANY

MYCO METAL PROCESSERS LTD. Cap. £5,000. To acquire the business of chemical processes and colouring of metals and working and exploiting of processes in connection therewith being part of the business carried on by Metal Processes Ltd., at Kingsbury Road, Erdington, Birmingham, and to carry on the business of manufacturers of and dealers in chemicals, dyestuffs, soaps, detergents, varnishes, paints, etc., and exploiters of part of the business of Metal Processes Ltd. Directors: M. Cooper, L. Deathridge, director of B.P.D. Products Ltd. Reg. office: 22 Florence Road, Sutton Coldfield, Warwicks.

## TRADE NOTES

### Terylene Spinning Plant

A Terylene polyester fibre spinning plant is to be built in Northern Ireland by Imperial Chemical Industries Ltd. if the market develops as expected. The new plant would be the first major Terylene spinning unit built away from Wilton and ICI's first works in Northern Ireland.

### Turner Bros. Asbestos' £4 million project

A £4 million development project at Turner Bros. Asbestos Co.'s factory at Hindley Green, near Wigan, has now been completed. Production has now begun at the south block of the factory which covers an area of 140 acres.

### PVC Centrifugal Fans

A comprehensive catalogue of p.v.c. centrifugal fans has been produced by Matthews and Yates Ltd., fan engineers,

Swinton and Turner and Brown Ltd., chemical plant engineers, Bolton. This catalogue gives general arrangement drawings and performance tables of the Turbo-Cyclone range of p.v.c. centrifugal fans from 100 c.f.m.-16,000 c.f.m. at varying pressures from  $\frac{1}{4}$  in.-3 in. S.P.F.

### Triplex Expansion at St. Helens

Triplex (Northern) Ltd., safety glass manufacturers, of Eccleston, St. Helens, and the Triplex Safety Glass Co. Ltd., of Birmingham, are to merge at the end of the present financial year in July. It is understood that there will be considerable expansion of the St. Helens works. Factory floor space formerly occupied by Ashdowns Ltd., the St. Helens plastics manufacturing firm which closed down at the beginning of the year, is being taken over and more plant is also being installed.

## Harwell Test on Nuclear Reactor

A TEST was conducted at the UK Atomic Energy Research Establishment, Harwell, recently, in which specially heated air was passed through the nuclear reactor BEPO under stringent conditions. This was a similar operation to that being carried out when the Windscale reactor accident occurred last October; then, however, the heat came from burning uranium fuel.

The Windscale accident was caused by the reactor being heated up too quickly during the second stage of a reactor maintenance operation carried out every six months. It involves heating the reactor furnace to a temperature above that at which it would normally operate.

Although the test on BEPO was routine,

very exceptional conditions were applied. Electrically heated air was fed into the reactor at a temperature of around 300° C to provide the heat although the reactor was not completely shut off. It was kept running at lower power so that tests could be carried out on the gear for detecting burst fuel cans.

The results are expected to provide valuable information on the future operation of reactor furnaces of the Windscale type.

New and more complex measuring and recording equipment is being ordered for the Windscale number 2 reactor, although a final decision has not yet been taken about the date of its recommissioning.

### Market Reports

## Cotton Slump Affects Chemicals

LONDON Business in the industrial chemicals market during the past week has pursued a steady course with no marked expansion reported in any section. The intake of the routine soda products against contracts continues to cover good quantities and in other directions the movement is unchanged on balance.

There has been a steady call for such items as tartaric and citric acids, hydrogen peroxide and formaldehyde. Copper sulphate has received a moderate enquiry and the price is unchanged, but quotations for zinc oxide are lower. Fertilisers are in brisk demand with reports indicating more enquiry for Chilean nitrate of soda.

There has been no change in the position of the coal-tar products, and available supplies are mostly moving against existing commitments. Home demand for cresylic acid remains good while among the light products the xyloids are in request.

MANCHESTER The contract movement of heavy chemicals on the Manchester market during the past week has continued

to be adversely affected by short-time working in the cotton industry, but other leading industrial outlets are absorbing fair tonnages, and so far there appears to have been no setback in the movement on shipping accounts. Fresh enquiries during the week have been on a moderate scale and covering a fair range of products. Prices generally are on a firm basis. A further improvement has been reported in the demand for fertiliser materials and most of the light and heavy tar products are finding a steady outlet.

GLASGOW Business in the majority of cases has continued steady during the past week in the Scottish heavy chemical market. There was, however, an upward trend from some sections of industry. Deliveries have been for the usual nominal quantities both in regard to spot and contract requirements. Prices have remained firm and shown little or no change.

Apart from the continued interest in forward bookings, agricultural chemicals still remain fairly quiet.

## DIARY DATES

**MONDAY 24 MARCH** SAC (Scottish Section)—Glasgow: Royal College of Science and Technology, 204 George Street Cl. 6.50 p.m. Introductory talk by J. Masek followed by film 'Polarography'.

**TUESDAY 25 MARCH** Fertiliser Society—London: Geological Society, Burlington House, Piccadilly W1. 2.30 p.m. 'An outline of the theory and practice of nitric acid manufacture' by D. A. Spratt.

**SCI Plastics & Polymer Group**—London: 14 Belgrave Square W1. 6.30 p.m. 'Ion exchange resins' by D. K. Hale.

**WEDNESDAY 26 MARCH** RIC (London Section)—London: Chelsea College of Science and Technology, Manresa Road SW3. 7 p.m. (LR 6.30 p.m.) 'Chemotherapy' by F. L. Rose.

**THURSDAY 27 MARCH** CS, RIC & SCI—Bristol: Chemistry Dept., The University. 6.30 p.m. 'Stereocchemistry and the transition metals' by Prof. R. S. Nyholm.

**OCCA**—London: Royal Society of Tropical Medicine and Hygiene, Manson House, Portland Place W1. 7 p.m. 'Some observations on the rheology of carbon black suspensions' by C. C. Mill.

**FRIDAY 28 MARCH** Institute of Metal Finishing—Sheffield: Grand Hotel. 7 p.m. 'Analytical control of plating operations' by Dr. E. Langford.

**RIC & SAC**—Stockton-on-Tees: William Newton School, Junction Road. 8 p.m. 'Residues in foods deriving from processing hygiene and manufacturing aids' by J. M. B. Coppock and R. A. Knight.

**SCI Corrosion Group**—Manchester: Robinson Lecture Theatre, The University. 6.30 p.m. 'Recent research on the corrosion of boiler tubes' by E. C. Potter.

### FAO Fertiliser Review

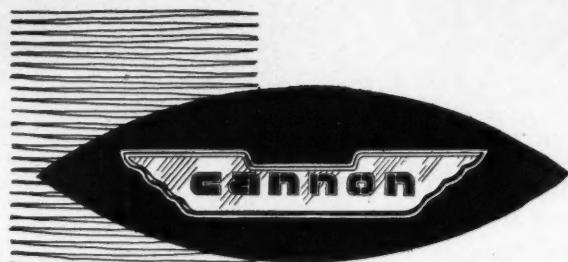
(Continued from p. 559)

which is indicated as likely to fall off in 1957 and 1958 to about the 1956 level. The small consumptions of S. America and Africa show moderate increases. Figures for Asia, however, which showed an increase by more than a quarter in 1956, are likely to show further important increases in 1957 and 1958, the total increase expected for 1956-58 being 44 per cent.

Europe and N. America together continued to use about 80 per cent of the world's total supply of phosphoric acid. Consumption in Europe shows a tendency to increase faster year by year from 1955 to 1958 compared with N. America where consumption has become practically constant. Asia's increased use of phosphoric acid is outstanding for 1955 to 1958. Africa also showed an important increase in 1956, although this was halved in 1957 and no further increase is forecast for 1958. Ground rock phosphate amounting to nearly 600 TMT of phosphoric acid is reported as being used annually for direct application. Over half of this total amount is used in the US. Of the remainder, about two-thirds is used in Europe.

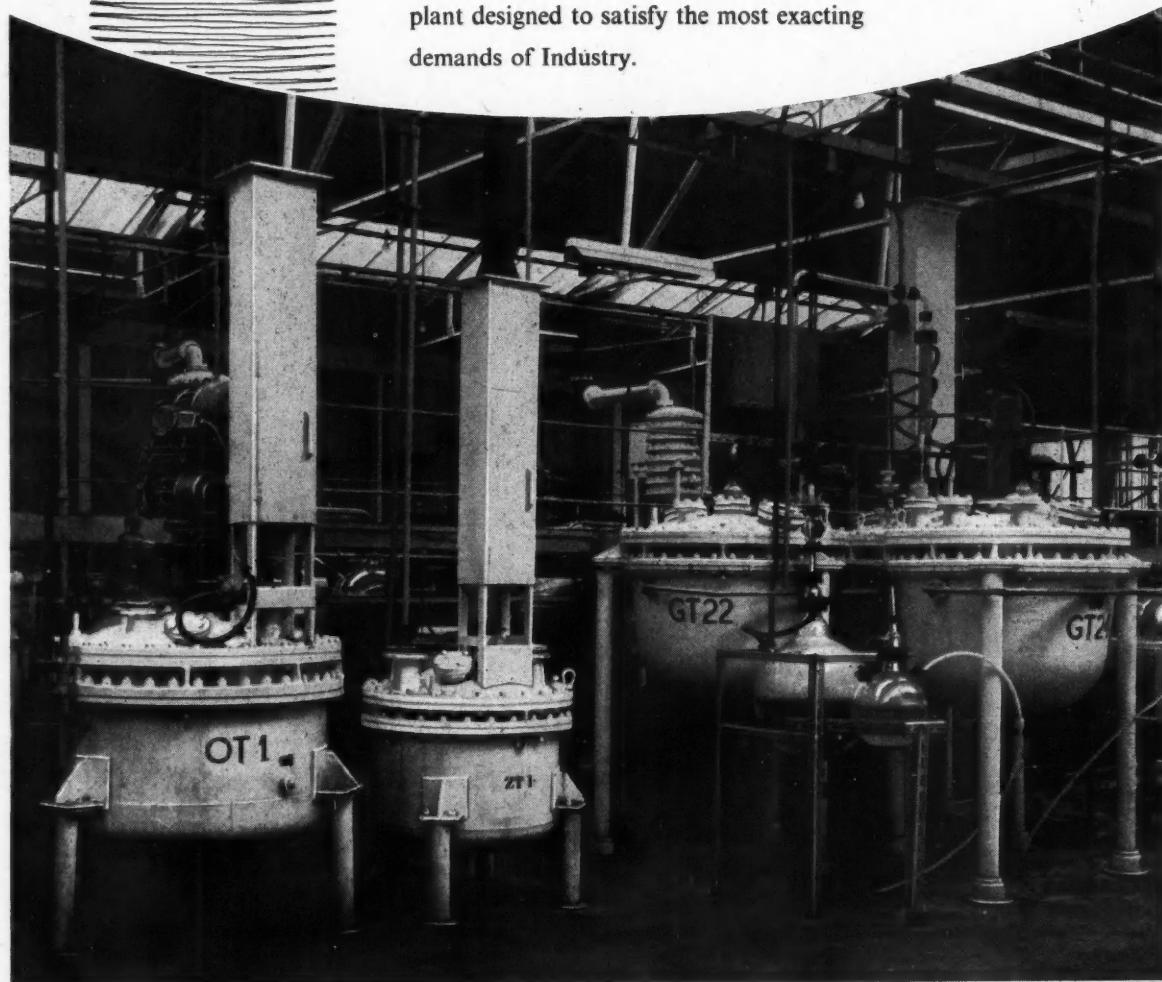
Potash consumption is stated to be increasing gradually in Europe, but in N. America has become stationary. Usage in S. America, Africa and Oceania is erratic from year to year, but in Asia potash consumption is also increasing and for 1958 a 10 per cent increase is forecast.

With regard to developments in fertiliser consumption, the FAO review reports that the marked interest in the use of urea has continued. The belief is expressed that, although some countries do not distinguish their returns between urea and other nitrogen fertilisers outside the common range, urea consumption is increasing and that this increasing demand is matched by increasing production.



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# NEW PATENTS

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Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents from 12 at any time within the prescribed period.

## AMENDED SPECIFICATIONS

Copies will be on sale 16 April or as soon as possible thereafter

Catalytic hydrogenation. Laporte Chemicals, Ltd. 746 385

## ACCEPTANCES

Open to public inspection 23 April

Production of condensation polymers. Monsanto Chemical Co. 793 780

Derivatives of aldosterone, and process of making them. Reichstein, T. 793 850

Purification of naphthalene. Coal Industry (Patents), Ltd. 793 946

Manufacture of 3-amino-indanes. Schering AG. 793 852

Delustering of cellulose acetate materials. British Celanese, Ltd. 793 697

Gas purifying apparatus. Holmes & Co., Ltd., W. C., Froggatt, R. J. C., Cullingsworth, J. E., and Cooper, C. 793 864

Apparatus for dispensing liquids. Firestone Tyre & Rubber Co., Ltd., and Collins, J. B. 793 627

Preparing a steroid. Ciba Ltd. 793 851

Detergent compositions for the hair. Ciba Ltd. 793 786

Thermal decomposition of certain chlorides and sulphates. Aman, J. J. 793 700

Process and apparatus for the electro-thermal production of magnesium. Knapsack-Griesheim AG. 793 629

Device for measuring and recording the density of a liquid. Imperial Chemical Industries, Ltd. 793 630

Glass compositions. British Thomson-Houston Co., Ltd. 793 866

Manufacture of asbestos cement tubes. Eternit Soc. Per Azioni. 793 971

Determination of impurities in water. Central Electricity Authority, and Scrase, H. F. J. 793 792

Process for the improvement of the surface properties of high polymeric substances free from cellulose or its derivatives. Dehydag Deutsche Hydrierwerke Ges. 793 934

Fabrication of high-polymer products from high-polymer compounds. Dehydag Deutsche Hydrierwerke Ges. 793 935

Substituted 1-aziridinyl quinones and a process for their preparation. Farbenfabriken Bayer AG. 793 796

Antibiotics. Glaxo Laboratories, Ltd. [Cognate application 1267.] 793 797

Process for the recovery of values from phosphate rock. Carothers, J. N., and Hurka, R. J. 793 801

Non-metallic magnetic materials. Imperial Chemical Industries, Ltd. 793 870

Method for removing sludges from tanks and for recovering oil from these sludges. Shell Research, Ltd. 793 633

Preparation of aromatic isothiocyanates. Nederlandse Centrale Organisatie Voor Toegepast - Natuurwetenschappelijk Onderzoek, and Naamlooze Vennootschap Chemische Industrie Rids. 793 802

Bonding of metal components to synthetic resinous moulded materials. Bakelite, Ltd. 793 874

Cobaltiferous dyestuffs of the benzene-monoazo-pyrozaline series. Imperial Chemical Industries, Ltd. 793 712

Coking of hydrocarbon oils. Esso Research & Engineering Co. 793 637

Derivatives of glyoxylic acid. Imperial Chemical Industries, Ltd. 793 807

Containers for granular or powdered or like materials. Allen (Birmingham), Ltd., W. G. 793 877

Production of amines. Imperial Chemical Industries, Ltd. [Addition to 716 239.] 793 716

Functional fluids. Monsanto Chemical Co. 793 639

Solutions of cellulose triacetates. Celanese Corp. of America. 793 858

Catalytic desulphurisation of hydrocarbons. British Petroleum Co., Ltd., Turner, R., and White, E. A. 793 812

Lubricating grease compositions. Wakefield & Co., Ltd., C. C. 793 813

2-Phenyl-2-alkylthioethylamines. Smith & Nephew, Ltd., T. J. 793 965

Desulphurisation of hydrocarbons and mixtures of hydrocarbons. Esso Research & Engineering Co. 793 817

Zirconium tetrachloride compositions. National Lead Co. 793 642

Preservation of tea. Monsanto Chemicals Ltd. [Addition to 776 166.] 793 976

Phosphates and a process for the manufacture thereof. Roche Products, Ltd. 793 722

Detection of sulphur dioxide. Mine Safety Appliances Co. 793 727

Apparatus and process for the production of boron. Norton Grinding Wheel Co., Ltd. 793 730

Bonding polytetrafluoroethylene. Du Pont De Nemours & Co., E. I. 793 731

Working up of water-soluble products obtained by reacting carbon monoxide with organic compounds. Badische Anilin- & Soda-Fabrik AG. 793 884

Bleaching cellulosic textiles. Food Machinery & Chemical Corp. 793 733

Manufacture of titanium, zirconium and hafnium. Imperial Chemical Industries, Ltd. 793 887

Production of aziridinoquinones. Farbenfabriken Bayer AG. 793 860

Manufacture of an artificial chamois leather article. Novacel. 793 888

Separation of liquids from gases or vapours. Koppers Ges., H. 793 989

Quartz crystal. Clevite Corp. 793 891

Mineral oil compositions. Esso Research & Engineering Co. 793 737

Chlorinated rubber manufacture. Hercules Powder Co. 793 663

Catalase composition and method of employing same. Armour & Co. 793 739

Cementing. Dow Chemical Co. 793 992

Preparing chlorinated aryoxy butyric acids, or salts or esters thereof. Faellesforeningen for Danmarks Brugsforeninger. 793 740

Film-forming composition with plasticiser of terephthalamide derivatives. Soc. Industrielle de la Cellulose (Sidac). Soc. Anon. 793 741

Inhibition of undesired polymerisation of monomers. Kharasch, M. S., and Nudenberg, W. 793 841

Fused magnesia and process of making same. Norton Grinding Wheel Co., Ltd. 793 743

Reinforced polymer compositions. Du Pont De Nemours & Co., E. I. 793 744

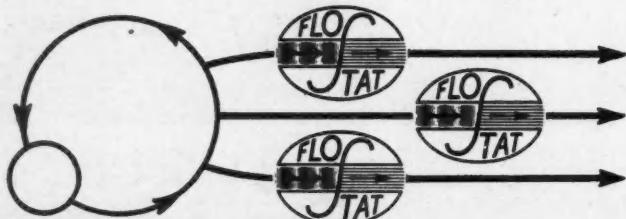
Process for the preparation of fluorinated chloromonsilanes. Grace & Co., W. R. 793 670

Process for the polymerisation of acetylene and apparatus thereof. Du Pont De Nemours & Co., E. I. 793 748

Fungicidal compositions. Armour & Co. 793 749

Manufacture of 1:1-difluoro-1:2-trichlorethane. Farbwerke Hoechst AG. 793 750

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